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BIOLOGICAL EVALUATION

For

MATERIAL RECOVERY AT OFFLOADING CONVEYOR
ASH GROVE CEMENT COMPANY
Duwamish Waterway, Seattle, WA

USACE File #2001-1-00155

Prepared by:

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For

U.S. Army Corps of Engineers
Seattle District

August 2001

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I. PROJECT DESCRIPTION

A. LOCATION:

Site Address: 3801 E. Marginal Way South, Seattle, WA

Property Description: Section 18, Township 24N, Range 4E, King County

Legal Description: APN: 766670-XXXX Parcel B SP8806165, LT19 BLK378
Seattle tidelands at a point 30.00' W of the SE corner of SO LN PHT being on the WLY. See file APN 766670-XXXX

Assessor's Tax Parcel ID #: 7666700395 and 76667000350

I.B DESCRIPTION:

I.B.1 Overview

The purpose of the proposed project is to reclaim approximately 600 CY of sand, gravel aggregate, and limestone rock that has fallen into the water within the barge unloading berth during the barge unloading process. This material is to be removed by clamshell to the authorized existing depth of the barge slip and re-introduced into the raw material stream of the plant's cement manufacturing process. Removal will take one day to perform.

I.B.2 Site History

The shoreline of the site was created when the Duwamish River was straightened to become the Duwamish Waterway, in 1917. As indicated by the vicinity map of Figure I.1, the site is located on the east bank of the waterway at the point where Harbor Island divides the channel into the East and West waterways.

The predecessor of the present cement plant was first constructed in 1925. At that time, all raw materials were delivered by ship. The site has been used continuously for cement manufacture since that period.

I.B.3 Site Characteristics (2001)

Figure 1.2 is a plan of the existing facility. The upland area occupied by the facility is roughly 23.7 acres. The length of frontage along the waterway is approximately 1200 linear feet. Existing improvements along the shoreline include a 60 ft x 400 ft wharf, two off-loading piers with conveyors and counterweight towers, and an access pier with dolphins for barge unloading equipment.

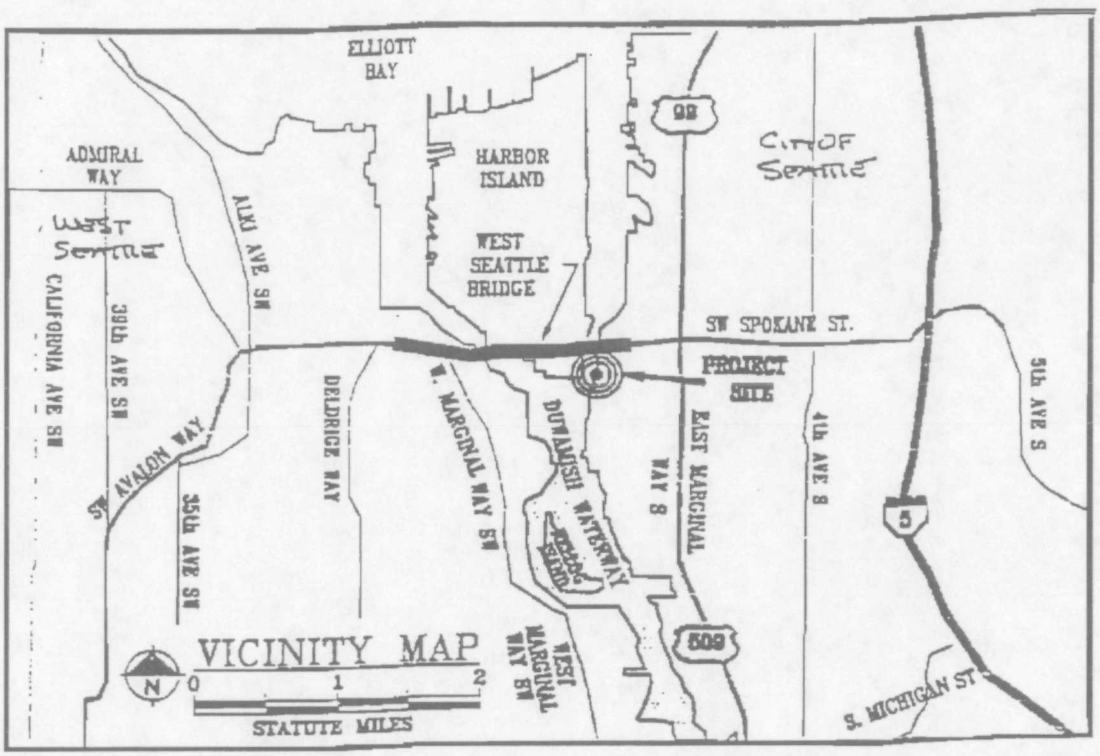

Figure I.1: Vicinity Map

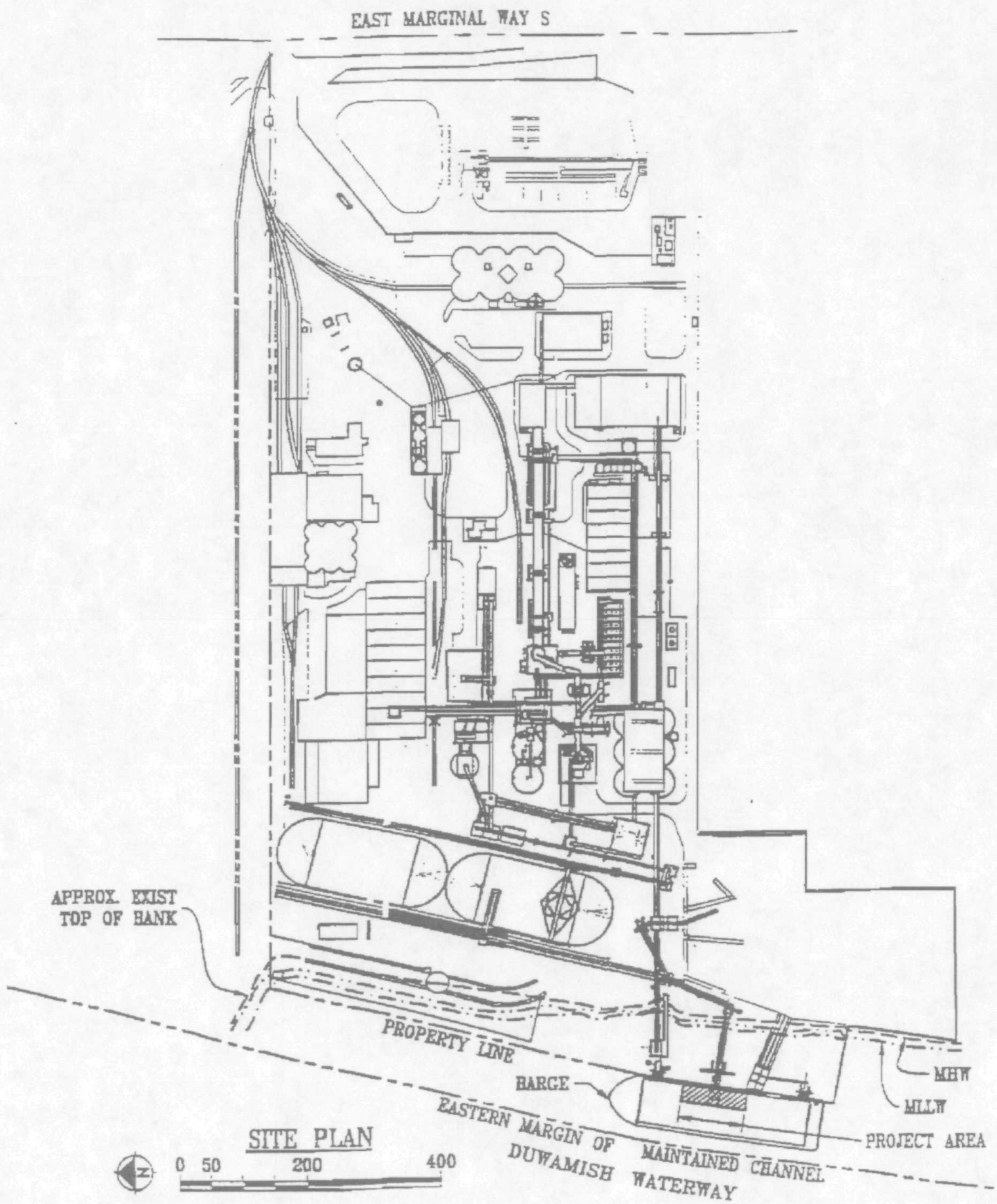

Figure I.2: Site Plan

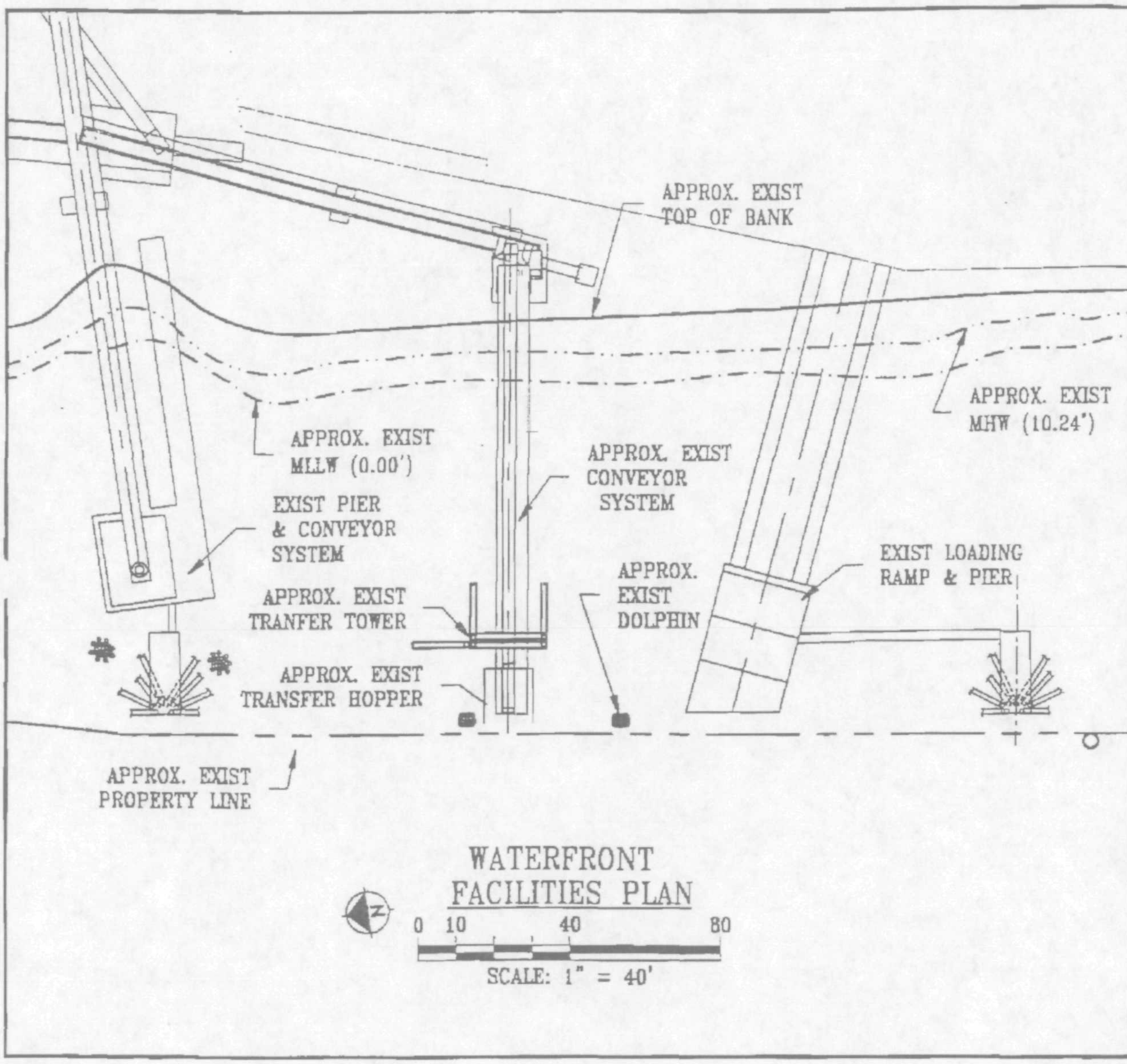

Figure L3: Sketch of Waterfront Facilities

The existing waterfront derricks, and off-loading conveyor systems are believed to date from the 1970s and were updated in the 1990s. The facility's waterfront berths were last dredged in approximately 1995. At that time, approximately 10,000 CY of sediment was removed from the berth along the breasting face to the wharf and dolphins.

The existing substrate in the vessel berth is Duwamish sand and silt, dredged to elevation -25 tidal datum. The authorized dredged depth of the waterway in this vicinity is elevation -30. The shoreline is armored with riprap at a slope of approximately 1.5H:1V.

Material was last removed from the berth at the conveyor, similar to the present proposal, in 1999, when 750CY was removed. At that time the USACE stated that a permit was not required by their agency. Current USACE regulatory policy indicates that a permit is now required. See Appendix C. Figure I.3 is a sketch of the waterfront, prepared for that permit application, and modified to reflect the present condition.

A brief description of the barge unloading process follows: First, the fully laden barge, with side boards to minimize spillage, is moored to the dolphins by the tug towing the barge. Second, a 7 CY loader is driven out the access pier and lifted via stiff-leg derrick on to the barge. A portable auxiliary hopper is also placed on the barge at this time. Third, the main conveyor is lowered adjacent to the barge. See photos of Appendix B, Figures 1,2, and 3. Fourth, the portable hopper and short feeder conveyor is set up on the barge deck to discharge to the fixed hopper on the main conveyor. The portable hopper prevents spillage that previously occurred when the loader collecting material piled on the barge discharged to the main conveyor hopper at the edge of the barge. This spillage has been significantly reduced since the portable hopper was introduced in 1995.

After the material is introduced into the main conveyor hopper, the material is discharged on to the rubber belt of the main conveyor. Sides are sealed at this point and no material is lost as the raw material is transferred onto the main conveyor. Reference the photo, Figure 4, Appendix B. Once on the conveyor, spillage is then minimized by a rigid cover over the conveyor, which catches errant particles and protects against weather effects. At the upper end of the conveyor, as shown in the photo, Figure 5, Appendix B, the rubber conveyor belt spills the material onto a second conveyor, which directs the material to a stock pile. The belt then goes around a roller to start its return trip to the barge end. At the discharge point to the second conveyor, as shown in the photo, Figure 6, Appendix B, a scraper held tightly to the belt surface scrapes excess material away, that would otherwise stick to the belt surface. As the belt returns to the barge on the underside of the conveyor, vibration frees the few remaining particles of material, which fall into the water.

Each year, roughly 1,000,000 tons of material is off-loaded as raw material at this site. This is roughly equivalent to 667,000 CY. The material off-loaded consists of clean, washed sand; clean washed aggregate, roughly 1 inch minus in dimension; and limestone rock, roughly 4 inch minus in dimension.

During the off-loading process, material is accidently dropped overboard from a number of sources. This material is speculated to have the rough proportions of 60% sand, 30% gravel, and 10% limestone. Most of the material collects directly under the conveyor hopper.

The volume of material accumulated since the last removal in 1999 totals roughly 600 CY. Based on an annual transfer volume of 667,000 CY, this amounts to a spillage rate of less than 0.045% for all causes.

I.B.4 Project Elements

It is proposed to remove the spilled material and re-introduce it into the raw material stream within the cement manufacturing process.

It is noteworthy that although there is always concern regarding introduction of contamination associated with sediment removal from the waterway, in the past other off-site dredging projects involving removal of contaminated sediments have safely disposed of contaminated dredge spoil by combustion in cement kilns such as, and including, the one operated on this site. The cement manufacturing process is sufficiently hot to decompose organic contaminates to constituent elements.

The spilled material has accumulated on the substrate in the vicinity of the off-loading conveyor. The affected area is roughly 100 ft x 30 ft. See the bottom bathymetry of Figure I.4. The spilled material shallows the berth and has the potential to damage the barge hull and perhaps cause the barge to capsize under some extreme circumstance. A large volume of material might then be spilled into the waterway adjacent to the berth.

Removal of the material is a one day project that should take no longer than two days maximum. Project timing will be established by the permit documents. Unless otherwise specified, removal is anticipated to take place between October 15 and February 14, as soon as possible after permits are issued. Subsequent removal is anticipated at intervals of roughly two years for a period of ten years after the initial action.

A floating crane with clamshell bucket and flat deck barge will be required to remove the material. The deck barge will have fences to contain material. These may be either barge structure or concrete ecology blocks with hay bales and filter fabric to serve as filters for any soil water discharged back to the waterway. Emergency spill booms will be available on the floating equipment.

The clamshell control lines are typically painted to allow the operator to remove material without excavating the substrate below the bottom of the accumulated spillage. The operator will work those areas indicated on the bathymetric drawing of Figure I.4 and field soundings made by the crew.

The material will be piled on the deck of the flat deck barge. When the removal is complete, the pile of material will be allowed to de-water. Granular material is expected to be almost immediately free-draining.

The barge will be towed to another site on the Duwamish Waterway, where it will be off-loaded by loader into trucks. The estimated volume represents roughly 60 truck loads. The trucks will travel across the low level Spokane Street bridge and deliver the material to subject cement plant where it will be re-introduced into the raw material stream.

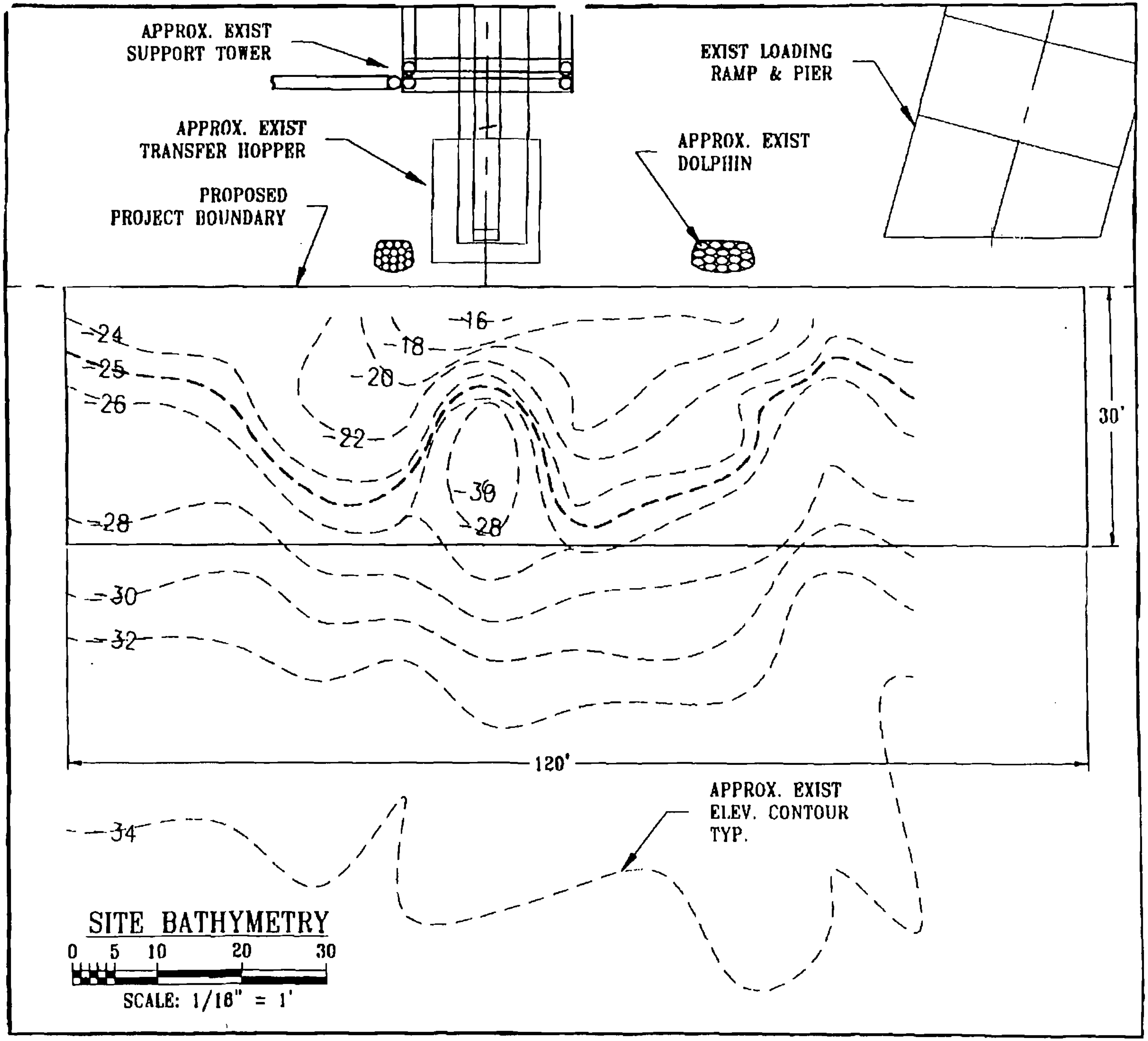

Figure L4: Site Bathymetry

I.B.4.a Proposed Project Elements

Remove accumulated raw material spillage at cement plant intermodal transfer point. Collect spilled material and place on flat deck barge. Relocate barge to off-site location to unload material from barge into trucks. Trucks to deliver material to cement plant for re-introduction into the cement manufacturing process.

I.B.4.a.i Proposed Material Removal

The proposed process includes the following:

1. Limit work in water to those periods authorized by WDFW Hydraulics Project Approval (HPA).
2. Enclosed deck area on flat deck barge with hay bales and filter fabric to minimize runoff turbidity.
3. Spill boom available on floating equipment
4. Material off-loading from barge to occur at off-site location. Material to be transferred to trucks and returned to cement plant on subject site as raw material for cement manufacturing.
5. Material removal to re-occur at unspecified future date(s), as authorized by permit conditions.

I.B.4.b Proposed Construction Timing

Table 1 is a time line indicating the periods during the year when each species of concern could be affected by the proposed construction; however, project timing together with proposed best management practices (BMPs) are designed to prevent all adverse effects. The key below Table I.1 describes the on-site presence and species activity throughout the year.

Table I.1 applies to in-water construction limitations. All in water construction must be avoided during Feb 15 through Oct 15 window referred to as the WDFW fisheries closure.

Table I.1 - Species Time Line at Project Site

Species	J	F	M	A	M	J	J	A	S	O	N	D
Chinook Salmon*												
Coho Salmon*												
Bull Trout												
Humpback Whale												
Steller Sea Lion												
Leatherback Sea Turtle												
Bald Eagle**												
Peregrine Falcon	REMOVED FROM ESA PROTECTION											
Proposed Construction												

KEY:	
	Closure
	May be present
	Proposed Construction
	Not present

* Chinook/Coho Salmon: for August, September, and the first two weeks of October "may be present" refers to returning adult spawners. They have been shown to be present in the project action area for very short periods, possibly migrating through at night.

** Bald Eagle: not likely to be present at project site, but may be present within the project action area.

For further information regarding individual species on-site preference, see Section II.B of this

I.C PROJECT ACTION AREA:

The action area is defined as the Green/Duwamish Estuary subwatershed (RM 0.0 to 11.0) (Kerwin and Nelson 2000).

The action area described above provides a range of habitats for salmonids and other organisms that inhabit these waters. These habitats include intertidal, shallow subtidal, and riverine. Baseline conditions in the action area are described in Section II.D.

The action has been chiefly built and committed to industrial development, with up to 95 years of continuous industrial use history. As a result, the action area includes a broad range of sediment conditions, dependent on (1) their location in the Duwamish Waterway and (2) the likely sources of chemical contamination. Numerous public and private projects in the Duwamish Waterway indicate that the primary chemicals of concern in the East Waterway include two groups: (1) contaminants found in many areas of the waterway, particularly mercury, PAH's, and PCB's, and (2) contaminants discovered in limited, specific locations, generally associated with sewer/stormwater discharge points, including DDT and other pesticides, silver, and TBT.

Adjacent to the project site at approximately river mile 2.0, intertidal and shallow subtidal habitats are generally engineered (1H:1V) slopes covered with riprap.

In general, production potential of native fish and wildlife species associated with urbanized and industrialized sites has been seriously impacted. Currently, approximately 70% of the historic Green/Duwamish watershed has been diverted out of the basin (Kerwin and Nelson 2000). Actions proposed to reverse these impacts on a property-by-property basis complement and are consistent with the landscape-scale management approach for Commencement Bay outlined by Simenstad (2000).

It has been proposed to list the action area as part of a federal Superfund site. The boundaries of this site, however, have not been defined (Hiltner 2001).

II SPECIES AND HABITAT INFORMATION

II.A SPECIES LISTED BY NMFS [www.nwr.noaa.gov]

II.A.1 Chinook Salmon (Threatened)

Chinook Salmon (*Oncorhynchus tshawytscha*). The relationship between ESA and metapopulation theory (e.g., Wiens 1996) is unclear. The general features of metapopulation thinking were outlined by Andrewartha and Birch in 1954 (Caughley 1994). The development of formal metapopulation theory and the coining of the term, however, are generally credited to Levins (1970), whose model addressed the generation of population stability (persistence) through a balance between local extinctions and recolonization of vacant, but suitable, patches. NMFS' Cumulative Risk Initiative (CRI)[1] appears to be an analysis based at least partially on metapopulation theory, directed at regionally listed fish species.

Both the Columbia and Fraser Rivers are near the center of the chinook's range along the north American coast (Healey 1991). Myers et al. (1998) discuss chinook salmon life history and ecology, genetic considerations, artificial propagation, risk assessment and biological information.

This ESU encompasses all runs of chinook salmon in the Puget Sound region from the North Fork Nooksak River to the Elwha River. Most chinook salmon in this ESU exhibit an ocean-type life history (Healey 1991). Although some spring-run chinook salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns. There are substantial ocean distribution differences between Puget Sound and Washington coast stocks. Coded wire tags from Washington coast fish have been recovered in much larger proportions from Alaskan waters (Myers et al. 1998).

In life history and genetic attributes, Elwha River chinook salmon appear to be transitional between populations from Puget Sound and the Washington coast ESU. A majority of the Biological Review Team considered that Elwha River chinook salmon were part of the Puget Sound ESU. A minority of the BRT felt that the Elwha River chinook belonged in the Washington coast ESU, and a further minority was undecided (Myers et al. 1998).

In addition to the Puget Sound and Washington coast, chinook are listed in 15 other ESUs, ranging south to central California and as far east as the Idaho/Montana border. This geographic area is large. Neither a federal recovery plan for Puget Sound ESU chinook salmon nor a regional conservation plan for the Green/Duwamish basin (WRIA 9) has been implemented. The latter is expected to be approved in 2005 (Kerwin and Nelson 2000).

[1]http://research.nwfsc.noaa.gov/cri/

Three variations of chinook salmon potentially occur in the Green/Duwamish system: native, hatchery and wild. Native fish have no hatchery genes, i.e., have never been genetically manipulated; hatchery fish are produced and raised for a portion of their lives in a hatchery; and wild fish are naturally produced but may possess previous hatchery pedigrees (WDFW 1997).

Like all pacific salmon, chinook reproduce in fresh water but the majority of their growth occurs in marine waters. Adults enter the river in late summer and early fall and spawn mostly in the mainstem and larger tributaries. Chinook juveniles rear in the Green River or its tributaries for a few weeks (ocean type) to over a year (stream type) before migrating downstream to the Duwamish Estuary/Elliott Bay and beyond. Chinook juveniles from other systems in the South Sound may also find their way into Elliott Bay and the lower reaches of the Duwamish Waterway during their outmigrations to the Pacific Ocean.

In watersheds with an unaltered estuary (and historically in the Duwamish Estuary), chinook smolts spend a prolonged period, i.e., several days to several weeks, during their spring outmigration feeding in salt marshes and distributary channels as they gradually transition into more marine waters (Simenstad et. al. 1982). Chinook fry and sub-yearlings in salt marsh and other shallow habitat predominantly prey on emergent insects and epibenthic crustaceans such as gammarid amphipods, mysids and cumaceans. As chinook mature and move to neritic habitat, they feed on small nekton (decapod larvae, larval and juvenile fish, and euphausiids) and neustonic drift insects (Simenstad et. al. 1982); see also detailed life history review in Healey (1991).

Chinook salmon prefer to spawn and rear in the mainstem of rivers and larger streams (Williams et. al. 1975; Healey 1991). In the Green/Duwamish system, chinook are present in the mainstem of Big Soos Creek, Newaukum Creek and, occasionally, Burns Creek. Historically, chinook were also found above the City of Tacoma's diversion dam at Palmer. Because of intensive hatchery planting programs over many decades, current runs of chinook in the system are primarily hatchery and wild.

The freshwater phases of fall chinook are shown in Appendix D. Most of these fish enter the estuary in July or August and remain there for a period of weeks or months. They move up the river to spawning areas or the hatchery between late September and late October, peaking around the first week of October (Becker, 1967). In the mid-1940's, hatchery fall chinook returned to the Big Soos Creek Hatchery two weeks later than they did in the mid-1960's (Miller and Stauffer, 1967). They attributed this phenomenon to the hatchery practice of collecting eggs from the first part of the run rather than throughout the run. Such a shift to an earlier upstream migration timing could increase the negative impacts of poor water quality on adult chinook passing through the Duwamish River and Estuary. During the 1960's, low dissolved oxygen and/or high temperatures were believed to cause fish to pause in the lower estuary before improving conditions induced them to move upstream (Miller and Stauffer, 1967).

Adult chinook spawning occurs in the mainstem Duwamish/Green river primarily between river mile (RM) 24.0 and RM 61.0 (Williams et. al., 1975). Heaviest spawning is found between RM 29.6 and 47.0, and RM 56.0 and 61.0 (Grette and Salo, 1986). Both reaches are WDFW index areas. In 1986, Hatfield Consultants Ltd. noted extensive spawning in the reach immediately below the City of Tacoma diversion dam (Grette and Salo, 1986).

Chinook hatch in mid to late winter and emerge from the stream bed gravel in late winter and early spring (Healey, 1991; Appendix D). Fry rear for a few weeks in quiet waters along the mainstem and in off-channel sloughs, feeding primarily on insects, before moving downstream. Ocean-type chinook move through the estuary slowly, feeding intensively on a variety of crustaceans and insects. The remaining shoreline mudflats in the Duwamish Estuary are especially important to juvenile chinook in that they provide the primary area for production of these prey.

Historically, a small run of spring chinook was reported in the Green River system (Grette and Salo, 1986). However, this information is based on anthropological reports and on the presence of spring chinook in the White River, not on reliable historical data specific to the present Green River watershed (Woodin, R., Washington Department of Fisheries [now WDFW], pers. comm., as cited in Grette and Salo, 1986). Grette and Salo (1986) examined the original hatchery ledgers and found no evidence that spring chinook were spawned at the Green River Hatchery.

Juvenile spring chinook are stream type and rear in the stream for from several months up to one year before outmigrating. Grette and Salo (1986) speculate that spring chinook would likely spawn and rear in the Green River from the downstream end of the gorge to the headwaters of the upper drainage.

Grette and Salo (1986) state that a large portion of the native chinook run in the Green/Duwamish River are natural or wild (i.e., some of their genes may be of fish hatchery origin). The hatchery stock of chinook salmon in the Green River was established by taking eggs from adults captured at a weir across the mainstem of the Green River (Becker, 1967). Prior to 1900 there were few if any chinook in Big Soos Creek, the site of the Green River Hatchery (Grette and Salo, 1986).

Currently there are two stocks of fall chinook salmon: Green/Duwamish summer/fall chinook, and Newaukum Creek summer/fall chinook. The former is distinct based on geographic distribution. The former has been frequently transferred into other Puget Sound basins in the past and is genetically similar to several other Puget Sound chinook stocks. The stock is mixed, with natural spawning throughout the river and hatchery production at Soos Creek. Studies have shown that a large portion of the natural spawning population is comprised of hatchery strays, indicating that natural escapement levels are partially dependent upon hatchery production (Washington Department of Fish and Wildlife (WDFW) and Western Washington Treaty Indian Tribes (WWTIT), 1994). Hatchery-produced chinook salmon in the Green River system are not considered to be part of the Puget Sound Evolutionarily Significant Unit.

According to WDFW and WWTIT (1994), the Green River chinook stock status is healthy based on recent escapement levels. The escapement goal set for this stock by WDFW is 5,800; this goal was exceeded in each of the years 1995-98. The average escapement for the past 22 years is 6,211; the lowest escapement of 1,840 occurred in 1982, and the maximum escapement of 11,512 occurred in 1989.

The Newaukum Creek summer/fall chinook stock is distinct based on geographic distribution (WDFW and WWTIT, 1994). This stock is largely native, but is influenced by hatchery strays whose origins are Green River and Icy Creek.

In the 1970's, different stocks of spring chinook were reared at the Icy Creek station; subsequently, returning adults were reported. As of 1986 they were not being raised at the state or tribal hatcheries (Grette and Salo, 1986), and there is no recent information that spring chinook persist in the system (WDFW and WWTIT, 1994).

Critical habitat (50 CFR Part 226) has been assigned (Vol. 65 Federal Register, p. 7764, Feb 16, 2000). Critical habitat encompasses accessible reaches of all rivers within the boundaries of the Puget Sound ESU for chinook salmon, including the action area and project site.

II.A.2 Steller Sea Lion (Threatened)

Steller sea lion (*Eumetopias jubatus*). The Steller sea lion was listed as a threatened species under emergency rule by NMFS in April, 1990; final listing for the species became effective in December, 1990. The range of the Steller sea lion extends around the North Pacific Ocean rim from northern Japan, the Kuril Islands and Okhotsk Sea, through the Aleutian Islands and Bering Sea, along Alaska's southern coast, and south to California (Kenyon and Rice, 1961; Loughlin et. al., 1984).

Eumetopias is the largest otariid (York et al. 1996). Its numbers have declined by over fifty percent since the 1960s, from an estimated 250K-300K to about 116K in 1989. Most of the decline has occurred in Alaska. The species' center of abundance has historically been in the eastern Aleutians. By 1985, population declines had spread eastward into the Gulf of Alaska, at least to the Kenai Peninsula. After 1989, population declines were observed in Prince William Sound. The (North American) Pacific coast range-wide population had declined from a total of 200K individuals in 1976 to 70,000 individuals in 1994 (York et al. 1996).

The western U.S. population (west of 144° W. longitude - Cape Suckling, AK) is listed as endangered under ESA. The status of Steller sea lion under the Marine Mammal Protection Act is "depleted", and it is listed as "endangered" on the International Union for Conservation of Nature (IUCN) Red List. No-trawl buffer zones have been established in and around the Aleutian Islands for the purpose of protecting rookeries. Presently, the area from southeastern Alaska through Oregon is the only region in which the total number of individuals is stable or increasing slightly.

The North American breeding range of Steller sea lions extends from southern California to the Bering Sea (Osborne, 1988). Breeding colonies consisting of small numbers of animals also exist on the outer coasts of Oregon and British Columbia. There are currently no breeding colonies in Washington State (NMFS, 1992), although three major haulout areas exist on the Washington outer coast and a major haulout area is located at the south jetty of the Columbia River (NMFS, 1992). Jagged Island and Spit Rock are used as summer haulouts, and Umatilla Reef is used during the winter (National Marine Mammal Laboratory, unpublished data). Generally, Steller sea lions favor offshore rocks for haulout areas (Norberg 2000); however, other rocks, reefs and beaches, as well as floating docks, navigational aids, jetties and breakwaters are also used for hauling out (NMFS, 1992).

Steller sea lion habitat includes both marine and terrestrial areas that are used for a variety of purposes. Terrestrial areas, e.g., beaches, are used as rookeries for pupping and breeding. Rookeries usually occur on beaches with substrates that include sand, gravel, cobble, boulder, and bedrock (NMFS, 1992). Haulout areas are used other than during the breeding and pupping season. Sites used as rookeries may be used as haulout areas during other times of the year. When Steller sea lions are not using rookery or haulout areas, they frequent nearshore or waters over the continental shelf. Some individuals may enter rivers in pursuit of prey (Jameson and Kenyon, 1977).

Steller sea lions are opportunistic feeders and consume a variety of fishes such as flatfish, cod and rockfish, and invertebrates such as squid and octopus. Demersal and schooling fishes predominate in their diets (Jones, 1981). Steller sea lions along the coasts of Oregon and California have eaten rockfish, hake, flatfish, cusk-eel, squid and octopus (Fiscus and Baines, 1966; Jones, 1981; Treacy, 1985); NMFS (1992) considers rockfish and hake to be consistently important prey items. Feeding on lamprey in estuaries and river mouths has also been documented at sites in Oregon and California (Jones, 1981; Treacy, 1985). Spalding (1964) and Otesiuk et. al. (1990) have documented Steller sea lions consuming salmon, but do not consider salmonids to be major prey items (Osborne, 1988). Off the Washington coast, their primary prey items are Pacific hake (*Merluccius productus*) and walleye pollock (*Theragra chalcogramma*). Secondary prey items include other schoolong fishes such as Pacific herring (*Clupea harengus pallasi*), smelts (Osmeridae), skates (Rajidae), spiny dogfish (*Squalus acanthias*) and salmonids (*Oncorhynchus spp.*).

Responses to various types of human-induced disturbances have not been specifically studied. Close approach by humans, boats or aircraft will cause hauled-out sea lions to enter the water. Disturbances that cause stampedes on rookeries may cause trampling and abandonment of pups (Lewis, 1987). Areas subjected to repeated disturbance may be permanently abandoned (Kenyon, 1962), and/or the repeated disturbance may negatively affect the condition or survival of pups through interruption of normal nursing cycles. Low level of occasional disturbance may have little long term effect (NMFS, 1992).

In Washington, Steller sea lions are uncommon; there are an estimated 600-800 Steller sea lions that occur year-round in Washington (Jeffries, S., WDFW, pers. Comm., 1999). No systematic surveys have been conducted on Steller sea lion abundance in Washington nor does WDFW have specific information on Steller sea lions in the Elliott Bay area. Their occurrence in Elliott Bay and the Duwamish Waterway is considered rare (Jefferies, S., WDFW, pers. comm., 1999). Pinniped surveys conducted by WDFW and NMFS indicate that small numbers of Steller sea lions have been sighted in the Strait of Juan de Fuca off the Olympic Peninsula, and in small numbers at six coastal haulout sites at the mouth of the Columbia River. Although Steller sea lions are not known to migrate, they do disperse at times of the year other than the breeding season. Animals marked in Oregon have been sighted in northern California, Washington, British Columbia and southeast Alaska (Calkins and Pitcher, 1982; Calkins, 1986). Based on the above, it is highly unlikely that Steller sea lions will be encountered in the project action area.

No Steller sea lions were observed in Elliott Bay during field studies for the Southwest Harbor Project in 1994 (U.S. Army Corps of Engineers (USACE) et. al., 1994). California sea lions (*Zalophus californianus*) were seen in the area at several different times and locations on three separate days (USACE et. al., 1994). The California sea lions were seen most often in the West (Duwamish) Waterway, but they were also seen north and west of the former Lockheed site. A harbor seal (*Phoca vitulina*) was seen once near the Lockheed piers.

Critical habitat was designated in 1993 (50 CFR 226.202), see Appendix E. However, rapid declines in the western population of *Eumetopias* have prompted a reevaluation of this designation, particularly with respect to the potential environmental impacts of Alaskan groundfish fisheries in the Gulf of Alaska and Bering Sea/Aleutian Islands[2]. Subject action area does not fall within designated critical habitat of this species.

With respect to the eastern population of *Eumetopias*, there is direct evidence of recovery (NMFS Alaska Region 2000 Steller sea lion BiOp, Section 3.7). Counts of non-pups (adults and juveniles) have increased overall from just under 15K in 1982 to over 20K in 1994. Counts of non-pups increased from a previously documented number of 4.7K, to 8.1K in 1994. Historically, 10K-12K individuals, including pups, were counted in 1913; however, this BiOp is unclear as to what specific area(s) the 1913 survey covered. Nevertheless, based on recent trends in southeast Alaska and British Columbia, prospects for recovery of the eastern population are encouraging.

[2]For detailed information, including descriptions of NOAA documents currently being reviewed, see http://www.fakr.noaa.gov/protected resources/stellers.htm.

II.A.3 Humpback Whale

Humpback whale (*Megaptera novaeangliae*). Endangered. Humpback whales are endemic to the North Pacific. They inhabit coastal waters and are typically found within approximately 50 nautical miles from shore (Evans, 1987; Calambokidis and Steiger, 1995). The coastal waters that attract the whales represent areas of high productivity of plankton and forage fish that are important food sources (Evans, 1987). They are dependent on these abundant food resources because of their size and their metabolic needs during other times of the year when food resources may be less abundant (e.g., on wintering grounds)(Evans, 1987).

Three groups have been identified based on summer and winter range distributions (Calambokidis et. al., 1997a). The population was reduced to about 13 percent of the carrying capacity by commercial whaling (Braham, 1991) and is now estimated to number between six and eight thousand individuals (Calambokidis et. al., 1997a). The three population groups spend the summer off the Aleutian Islands to Southeast Alaska, the Washington/British Columbia coast, and California. The Alaska group migrates to winter grounds in Hawaii. The group off the Washington/British Columbia coast splits between three wintering areas in Hawaii, Mexico and Japan. The California group migrates primarily to wintering grounds off Mexico to Costa Rica (Calambokidis et. al., 1997a, 1998a). The greatest number of animals winter off Hawaii (about 4,000 to 5,000), with Mexico second (1,600 to 4,200) and Japan representing the smallest wintering group (about 400). The summer grounds are used for feeding while the wintering grounds are used for breeding and calving (Evans, 1987).

Humpback whales use coastal habitats because of their productivity. They would not be expected to be present in Puget Sound because of lack of appropriate habitat and food availability. This expectation is based on limited data, as most studies of these animals are focused on areas frequented by the whales. The Cascadia Research Institute conducts studies on marine mammals in Puget Sound and throughout the North Pacific Ocean. They have reported no humpback whales as incidental sightings in Puget Sound during recent marine mammal surveys (Calambokidis et. al., 1994, 1997b; Calambokidis and Quan, 1997; Calambokidis, 1996). Cascadia Research Institute did site a humpback in Puget Sound in 1985, and a humpback was seen in the Strait of Juan de Fuca in June of 1999 (Cascadia Research Institute, pers. Comm., 1999), indicating that their usage of Puget Sound is rare or nonexistent.

Responses to various types of human-induced disturbances have not been specifically studied. Close and fast approaches by boats or aircraft may cause humpback whales to disperse or interrupt feeding, migrating or nursing activities. Little is known about what effects, if any, activities associated with coastal development might have on humpback whales. Certain man-made sounds cause migrating whales to deviate from their course (Tyack et. al., 1983). Daily dredging and vessel traffic in a calving lagoon caused gray whales to abandon the area for six years (Rice et. al., 1984). Feeding or breeding areas subjected to repeated disturbance could potentially be abandoned, and/or repeated disturbance could negatively affect the condition or survival of calves through interruption of nursing cycles. These disturbed areas are not located in subject action area or in Puget Sound.

Abundance estimates from a recent major collaboration among researchers in the North Pacific Basin indicate that six to eight thousand humpback whales inhabit the region. These animals distribute themselves along the Pacific Coast of North America during the summer for feeding (Calambokidis et. al., 1997a). Calambokidis et. al. (1998b) characterize the population as showing a higher proportion of calves in recent years that are "closer to that expected of a healthy increasing population." Comparisons of current abundance estimates with the estimated abundance at the end of commercial whaling in the 1960's of around 1,400 in the North Pacific basin indicate a growing population. Thus, the current stock status appears to be one of a healthy, increasing population.

II.A.4 Leatherback sea turtle

Leatherback sea turtle (*Dermochelys coriacea)* Endangered. No nesting occurs on beaches under U.S. jurisdiction. Leatherbacks have been reported in coastal waters off Oregon, Washington and British Columbia. Primary threats to this species are (1) incidental takes in coastal and high seas fisheries, (2) human-induced mortality on nesting beaches (Mexico, e.g.) and (3) ingestion of marine debris. Neither critical habitat nor protected areas have been established along the U.S. Pacific coast (NMFS and USFWS 1998).

Dermochelys sightings have not been documented in Washington State's inland waters, but individuals are seen in offshore coastal waters with some regularity (Norberg 1999). Washington State classified this species as State Endangered on 8/25/99.

II.A.5 Coho salmon

Coho salmon (*Oncorhynchus kisutch*) Candidate. In October, 1993, NMFS initiated a status review of coho salmon in Washington, Oregon and California, and formed a Biological Review Team to conduct the review. Six ESUs were identified, including the Puget Sound/Strait of Georgia ESU. On 7/25/95, NMFS determined that listing was not warranted for the Puget Sound/Strait of Georgia ESU (Weitkamp et al. 1995); however, the ESU was designated as a candidate for listing due to concerns over specific risk factors. As a result, there are currently no protective measures such as 4(d) rules or critical habitat designation(s) in place for coho.

Hart (1973) describes the distribution of *O. kisutch*: From Baja California ... through California to Norton Sound and possibly Kotzebue Sound, and as strays in the Sacramento River. The center of abundance is between Oregon and southeast Alaska. Through the Aleutian Islands. Down the Asian coast from Anadyr, Kamchatka, northern Sea of Okhotsk, Kuril Islands, Hokkaido, northern Honshu and Korea.

In estuaries, where they feed actively and grow rapidly, coho smolts are vulnerable to predation by cutthroat trout (*O. clarki clarki*), Dolly Varden (*Salvelinus malma*), bull trout (*Salvelinus confluentus*), great blue heron (*Ardea herodias*), mergansers (*Mergus, spp.*), dogfish (*Squalus acanthias*), Bonaparte's gull (*Larus philadelphia*) and marine mammals (e.g., *Phoca vitulina*).

Coho diet items include crustaceans (copepods, amphipods, barnacle and crab larvae, and euphausiids), insects and fish (e.g. *Ammodytes hexapterus, Clupea harengus pallasi, Sebastes, spp., Hexagrammos decagrammus* and *Thaleichthyes pacificus*) (Hart 1973).

After leaving the estuary, coho are not as anthropologically influenced by habitat degradation as by harvest practices. Coho, similar to chinook salmon, utilize the project action area only for migration purposes. Their outmigration pattern peaks in mid to late May. Adults return through the action area later in the summer.

No project elements are proposed to occur during the presence of any life history phase of coho salmon within the action area.

II.B U.S. FISH & WILDLIFE SERVICE LISTED SPECIES

Appendix F contains USFWS species information (Grettenberger 2001). This correspondence includes a list of eighteen species of concern, including documentation of American peregrine falcon (*Falco peregrinus anatum*) activity within one mile of project site. This taxon was delisted on 8/25/99 due to recovery (64 FR pp. 46541-46558). Its status is currently being monitored nationwide. The location of the falcon eyrie closest to the project site is a nest within the West Seattle Bridge.

II.B.1 Bull Trout

Bull trout (*Salvelinus confluentus*) Threatened. *S. confluentus* are char native to the Pacific northwest and western Canada. *Salvelinus*, however, is distributed around the earth throughout northern latitudes. Bull trout are members of Phylum Chordata, Subphylum Vertebrata, Class Osteichthyes, Order Salmoniformes, Family Salmonidae (Lagler et al. 1962). Salmoniformes is a diverse group of families of soft-rayed fishes marked by the inclusion of the maxillary bone in the gape of the mouth, the consolidation of hypural bones on a terminal half-centrum, the absence of orbitosphenoid and mesocoracoid bones, and the presence of an adipose fin (Hart 1973). The order contains freshwater, anadromous, marine and deep-sea fishes. Salmonids possess cycloid scales, a distinct axillary scale, and the last three vertebrae are turned dorsally. Their gas bladders are connected to ailementary tracts by ducts. Oviducts are incomplete, replaced by a peritoneal fold. Pyloric caeca are numerous. Sexual dimorphism is strongly developed at spawning time. The family includes salmon, trout, chars, whitefish and related species (Hart 1973).

Trotter's (1987) description of the genealogy of salmonid fishes indicates that *Salvelinus* developed well before the differentiation of *Oncorhynchus*, predating the latter by as many as four million years. The geographic ranges of bull trout and Dolly Varden (*S. malma*) overlap where the Interior Plateau abuts against the Coast Mountains from northern British Columbia southward to northern Puget Sound (McPhail and Baxter 1996).

Four bull trout life history types understood prior to 1999 were (1) anadromous (hatch in freshwater/mature in saltwater/return to freshwater to spawn), (2) adfluvial (spawning and early rearing in streams with most growth/maturation occuring in lakes and reservoirs), (3) fluvial (spawning and early juvenile rearing in smaller tributaries with major growth and maturation occurring within mainstem rivers) and (4) resident (all life history stages occurring in small headwater streams, often upstream from impassable physical barriers). Taylor et al. (1999) recognize amphidromy as a fifth life history strategy. Amphidromous fishes make short forays into nearshore marine waters.

Taylor et al. (1999) conclude that (1) bull trout are subdivided into coastal and interior lineages; (2) this subdivision reflects recent historical isolation in two refugia south of the Cordilleran ice sheet during the Pleistocene (i.e., Chehalis and Columbia refugia) and (3) most of the molecular variation resides at the interpopulation and inter-region levels. Conservation efforts, consequently, should focus on maintaining as many populations as possible across as many geographical regions as possible within both coastal and interior lineages.

Cavender (1978) presented morphometric, meristic, osteological and distributional evidence to distinguish between bull trout and Dolly Varden. However, Cavender (1978) is not universally recognized or applied because (1) his analysis used museum specimens only, (2) his assumptions utilized the typological species concept, (3) he does not incorporate ecological information into his study and (4) his analysis of only single genetic characters without statistical rigor is inadequate (Haas and McPhail 1991).

S. confluentus and *S. malma* were recognized as distinct entities by the American Fisheries Society in 1980. Bull trout and Dolly Varden coexist in northwest Washington State river drainages (Dungeness, e.g.), and there is evidence of a single bull trout individual collected from a nearshore environment in central Puget Sound (Haas and McPhail 1991).

Bull trout appear to have more specific habitat requirements than other salmonids. Temperature, channel stability, flow extremes, substrate, cover and the presence of migration corridors consistently appear to influence bull trout distribution and/or abundance (Oliver 1979; Leathe and Enk 1985; Thurow 1987; Ziller 1992).

Temperature represents an important habitat characteristic for all bull trout life stages (USACE et al. 1999). Temperatures above about 15°C are thought to limit bull trout distribution and production (Rieman and McIntyre 1992; Goetz 1994).

Five distinct population segments (DPSs) of bull trout have been recognized by USFWS in the coterminous United States. The project action area lies within the Coastal/Puget Sound DPS. This DPS was listed on June 10, 1998 (63 Federal Register Page 31647+). This evolutionarily significant unit includes 35 subpopulations of char, both bull trout and Dolly varden, grouped geographically into five analysis areas. The project site and action area fall within the Puget Sound analysis area.

No critical habitat has been designated.

The status and occurrence of anadromous populations of bull trout in Puget Sound are subject to debate; separation of anadromous bull trout from the closely related anadromous Dolly Varden char (*S. malma*) is difficult and can only be accomplished using electrophoretic techniques (Leary and Allendorf, 1997). Until further resolution is possible, WDFW has decided to manage all Puget Sound stocks as if they were a single bull trout/Dolly Varden complex (Washington Department of Wildlife, 1993).

Newly hatched bull trout, including individuals destined for anadromy, emerge from the gravel in the spring (WDFW, 1998a). They typically spend two years in fresh water before they migrate to saltwater, the mainstem of rivers, or reservoirs, although there are populations of bull trout that do not exhibit this behavior; these trout spend their entire lives in the same stretch of headwater stream. These fish may not mature until they are seven to eight years old, and rarely reach sizes greater than 14 inches fork length (WDFW, 1998a).

Bull trout are opportunistic feeders, eating aquatic insects, shrimp, snails, leeches, fish eggs and fish. Early beliefs that these fish are serious predators (sic) of salmon and steelhead are generally not supported today (WDFW, 1998a).

Bull trout are not believed to spawn in the Green/Duwamish system (Cropp, T., WDFW, pers. comm., 1998). Those that are occasionally found in the Duwamish are believed to enter the river from other systems, spending time in the Duwamish Waterway but not migrating upriver to spawn. WDFW does not monitor bull trout in this system because, according to its records, bull trout do not spawn in this system.

Section III of this report (Effects of the Action), assumes bull trout may be present within the action area and in the vicinity of the proposed project site.

WDFW (1998b) reports that (1) bull trout population status in the Green River basin is unknown; (2) no studies confirm reproduction of bull trout/Dolly Varden in the Green River basin; (3) spawn timing is unknown and (4) data with which to infer average run size distribution is not available. Furthermore, U.S. Fish and Wildlife Service believes bull trout are present. For the purposes of this evaluation, bull trout are considered as though they may be present in the action area at certain times of the year; however, this project proposal minimizes the liklihood of adverse impacts to individuals and/or populations.

II.B.2 Bald Eagle:

Bald Eagle *(Haliaeetus leucocephalus)* Threatened; proposed delisted.

Its distribution is continent-wide, Canada and Alaska to southern United States. Its habitats are coasts, lakes and rivers in open and forested areas. Its nests are expansive quantities of sticks and small tree limbs in tops of tall, sometimes dead, trees. Nesting eagles prefer unobstructed views. Eagles have also been documented nesting on cliffs. Major threats to successful eagle life history completion, including natural reproduction, have been DDT and PCB poisoning. Both contributed to severe thinning and distortion of eggshells. Significant declines in individuals and populations began in the 1940s. Recent data has demonstrated that the species has recovered. A proposal has been submitted to delist *Haliaeetus* (64 Federal Register p.36453+).

The nest closest to the project site is at Duwamish Head, approximately 1.8 miles to the northwest. Information on how action area bald eagles population trends fit the goals and objectives of the USFWS Pacific Region bald eagle recovery plan (USFWS 1986)[3] is unknown. This recovery plan was unavailable for reference purposes; however, additional information can be provided if necessary.

Ambient noise levels detectable from the project site have not been studied; however, individual birds which may be nearby during proposed material removal are likely acclimated to noise levels resulting from heavy industrial activities. Industrial noise is present in this portion of the action area on a sustained basis over time. Whenever elevated noise levels cause bald eagle avoidance of the area immediately adjacent to the project site, affected birds will find necessary food sources at alternate sites within their established feeding territories.

[3]Delisting goals for Pacific Region bald eagle populations: A minimum of 800 nesting pairs with an average reproductive rate of 1.0 fledged young per occupied breeding area, and an average success rate for occupied breeding areas of not less than 65% over a five year period are necessary for recovery. Attainment of breeding population goals should be met in at least 80% of management zones. Wintering populations should be stable or increasing (64 Federal Register p. 36453+).

II.C SPECIES USE SURVEYS

In the mid to late 1960s, Fisheries Research Institute at the University of Washington conducted the Estuarine Ecology Study (Salo, 1969). This project focused on the ecology of pelagic and demersal fishes in the estuary and nearshore marine environments at a time when the estuary was receiving large amounts of industrial and domestic waste discharges. This investigation included studies of the estuarine and early marine life of immature chinook salmon, including mortality, distribution and growth; the estuarine life of adult chinook salmon; and the ecology of resident demersal species of the Duwamish estuary. Another objective of the study was to record certain water quality parameters in the Duwamish estuary and compare them with the known environmental requirements of salmon and other fishes of economic importance. Salo (1969) used mark-and-recapture methods to assess mortality rates among chinook fingerlings during downstream migration from the Green River Hatchery to the Duwamish estuary. Tow-net samples were taken to determine temporal and spatial distributions of fingerling salmon in more open waters. Salinities, temperatures and dissolved oxygen concentrations were taken at each of the tow-net sample sites. Growth and scale development also were studied.

Salo (1969) found that chinook fingerlings were present in the estuary for at least two months. After the downstream migration from the river was completed, the numbers of chinook fingerlings in the estuary decreased steadily. Fingerlings were found to congregate in schools and were most abundant along the shores of Elliott Bay and in the Duwamish River. Salo had difficulty estimating growth of individual fish but believed that the larger fish entered the estuary first. He also believed that the rate of passage through the estuary was greater for larger fish, as suggested by the earlier work of Phinney (1968) in an Alaskan estuary.

In adult salmon studies, Salo (1969) reported the center of adult salmon distribution to be about two miles above the mouth of the estuary from late August through early September. At the time, dissolved oxygen ranged from 4.2 to 7.4 mg/l at RM 1 and decreased steadily upstream to RM 3.75 (16th Avenue). This reach had the lowest dissolved oxygen concentration in the estuary, with concentrations consistently below 5.0 mg/l until mid-September. After mid-September, dissolved oxygen concentrations rose and the fish began to move upstream. Water temperatures ranged between 55 and 61 degrees Fahrenheit and increased with distance from the mouth of the river; these temperatures would not be expected to limit chinook migration.

Salo concluded that migration timing was influenced by dissolved oxygen concentrations, with fish milling about in the lower estuary until the dissolved oxygen concentrations increased.

Meyer et al. (1981) studied the distribution and food habits of juvenile salmonids in the Duwamish estuary. They found 21 species of fish during beach seining and purse seining between April and late July, 1980. Juvenile chum and chinook were the most prevalent salmonids caught in beach seines, and they were the most abundant salmonids captured in purse seines fished in deeper offshore waters. Chinook salmon abundance peaked twice, once in May and again in early June, coinciding with releases from upstream hatcheries. They were present in the estuary at least from April 8th, the date of first sampling, to July 31st, the last day of sampling.

According to Meyer et al. (1981), chinook were found in both shallow and deep water habitats, although they were predominantly found in shoreline areas; distribution was influenced by the size of the fish, with offshore fish being larger. These larger fish appeared to move inshore at night.

Epibenthic crustaceans composed the majority of salmonid prey at night, whereas pelagic crustaceans (e.g., calanoid copepods) insects and, to some extent, juvenile fish were a more significant diet item during the day (Meyer et al., 1981). They also found that in nearshore areas, salmonids relied more on epibenthic invertebrates, whereas pelagic organisms were the primary prey of fish in the mid-channel areas. They reported that the most productive areas in the Duwamish estuary were the soft-bottomed sites where high numbers of benthic and epibenthic invertebrates were found. Riprapped shorelines also contained salmonid prey items but in lower abundance. The least productive areas were found under concrete aprons, where little natural light penetrates.

Parametrix (1990) conducted a biological assessment of Terminal 107 (Kellogg Island) for the Port of Seattle in 1989. They studied water quality and food habits of juvenile salmonids in the lower Duwamish River. They concluded that poor water quality created a limiting situation to Kellogg Island's epibenthic productivity. However, they did not determine the limiting influence on epibenthic productivity of moderate levels of oil and grease in the shallow channel to the west of the island. They found no evidence of anaerobic conditions in surface sediments west of the island. Epibenthic zooplankters that prefer silty sediments were present in fair numbers on the mudflats west of the island.

Chum and chinook salmon were captured in beach seines at Kellogg Island in May, 1989 (Parametrix, 1990). Coho were not captured in this area during this or previous studies (Parametrix, 1990), and likely are only present near Kellogg Island for a few weeks in early May. Based on this information, Kellogg Island and other relatively intact lower Duwamish nearshore habitats are particularly important to juvenile chum and chinook.

Parametrix (1990) found that the cumacean *Cumella vulgaris* was the most important prey item for both chum and chinook juveniles. They concluded that these fish are opportunistic feeders because in previous studies the primary prey of chinook were gammarid amphipods, insects, larval fish, calanoids and mysids. Additionally, previous studies found that dipterans were the most important prey for chum salmon. Calanoid copepods, gammarid amphipods and harpacticoid copepods were also important prey items for chum. In conclusion, Parametrix (1990) found that the silty sediment mudflats around Kellogg Island were very productive for small harpacticoids; stations with finer sediments were found to have a greater abundance of zooplankton.

Cordell et al. (1997,1998) have monitored epibenthos and insect production at three restoration sites along the lower Duwamish River. They report that, after two to three years, the production of prey organisms is generally comparable to that in nearby control areas, and that juvenile salmonids, including chinook, are actively using and feeding in these areas.

II.D EXISTING ENVIRONMENTAL CONDITIONS/ENVIRONMENTAL BASELINE

II.D.1 ACTION AREA ENVIRONMENTAL BASELINE

The Duwamish River is that portion of the Green River downstream of the historic confluence with the Black River. With the diversion of the Cedar River in 1916, the Black River was left almost dry. Today, the only flow in the Black River comes from the tributary streams that drain from the eastern bluffs of the Green River valley.

The urbanization and industrialization of this portion of the Green River watershed has resulted in an extensive system of filled tidelands and flood control revetments that have eliminated (1) connectivity to the historic floodplain, (2) stream channel complexity, (3) functioning riparian zones and (4) floodplain habitats. In the Duwamish estuary, over 97 percent of the historic estuarine mudflats, marshes and forested riparian swamps have been eliminated by channel straightening, draining, dredging and filling. All (100 percent) of the tidal marshes bordering the Duwamish were filled by 1940 (Kerwin and Nelson 2000), reference Appendix K. The remaining shortened channel has been simplified and suffers from polluted sediments along with stormwater and wastewater effluent. Currently all salmonid species migrate, rear and acclimate in this transitional area between river and marine waters. Juvenile chinook and chum salmon are most dependent on this type of habitat.

This entire subwatershed is located in an Urban Growth Area (UGA). The project action area (Green/Duwamish estuary subwatershed) is characterized by industrial development (43%) and residential development (39%), reference Appendix G. The cities of Seattle and Tukwila, the operations of the Port of Seattle (fifth largest port in U.S.), and the region's largest industrial complexes are in this subwatershed. In the lower portion of the estuary, the loss of estuarine and riparian habitat has been extensive. The estuary shoreline has been altered dramatically (Kerwin and Nelson 2000):

1. 21K lineal feet of estuarine shoreline have been lost due to channel straightening.
2. 53K lineal feet have been filled and developed.
3. 19K lineal feet of vegetated riparian shoreline remain.
4. Approximately 3.9K acres of tidal mudflats and marshes have been reduced to 45 existing acres.
5. 97 percent of the estuary has been filled.

Major land use changes which have emerged during the past 150 years include (Kerwin and Nelson 2000).

1. 1851 European settlement begins along the Duwamish River.
2. 1880-1910 Logging occurs across much of the watershed and in the lower river valley; agricultural land use expands.
3. 1911 White River is diverted from Green River to Puyallup River for flood control, reducing watershed area by 30 percent.
4. 1913 City of Tacoma begins diverting water from Green River to provide water for homes and industry. Anadromous salmonids are blocked from upper Green River subwatershed.
5. 1916 Black and Cedar Rivers are diverted from Duwamish River to Lake Washington to improve navigation, further reducing watershed area by 40 percent from its original size.
6. 1900-1940 Duwamish estuary tidelands are filled, drained and dredged to support growing industrial and port activities.
7. 1895-1980 The Green/Duwamish River is channelized and diked for navigation and flood control.
8. 1945-present Residential, commercial and industrial land uses expand, largely replacing farmlands and forests in the western half of WRIA 9.
9. 1962 Howard Hanson Dam is completed for flood control purposes.

During the half-century beginning in 1917, land use changes, particularly in that portion of the Green River watershed upstream from the action area, are described as follows. From 1910 to 1930, timber production peaked in middle and upper WRIA 9. The Great Depression slowed this production beginning in 1930. Coal production peaked in 1918 following earlier coal finds in Renton and Black Diamond. The coal production later decreased as alternative energy sources were found, and sand and gravel production became more important as a result of the increased demand for industrial, residential and road development (Fuerstenberg 1999).

Between 1930 and 1960, the Puget Sound Region (King, Pierce, Snohomish and Kitsap Counties) was one of the fastest growing regions in WA. The human population doubled during that period, growing from 737K to more than 1.5M (Kerwin and Nelson 2000). Most of this growth occurred in the 1940s, accompanying stepups in defense production. Due to high birth rates and continuing defense production, this growth continued through the 1950s but at a reduced rate. King County's growth rate mirrored regional growth rate. Between 1930 and 1960, King County's population increased from 464K to 935K individuals. Most of this growth occurred between 1940 and 1950 (KCPD 1964).

One area in particular experienced a dramatic increase in urbanization. The prime farmlands of the lower Green River valley from Auburn to Tukwila were converted to warehouses, shopping malls and industry due to the proximity of roadway systems, reduced threat of flooding (i.e., the presence of Howard Hanson Dam), and the flat, easily developable land. Between 1965 and 1989, agricultural land uses in the lower Green subwatershed dropped by 70%, from 11.1K to 3.4K acres, while industrial and warehouse areas increased by 500+% (1.2K to 6.6K acres) (Scarey 1994).

1970-2000 was a period during which accelerated urban planning and environmental awareness were evident. Various environmental concerns were the basis for more stringent regulatory frameworks. The WA State Environmental Policy Act was adopted in 1971. Other planning concepts which arose during this period included shorelands protection, farmlands protection, the WA State Growth Management Act (1991) and wetlands protection.

From Kerwin and Nelson (2000), the principal habitat limiting factors and impacts within the mainstem Duwamish River/Waterway are urban and industrial land use practices listed below:

1. Dredging, channelizing and filling 97 percent of the estuarine mudflats, marshes and forested riparian swamps that formerly comprised the estuary.
2. Simplifying the remaining channel/severely reducing riparian function.
3. Polluting the remnant, shortened channel with stormwater and wastewater effluent.

The Duwamish River originates at the confluence of the Green and Black Rivers near Tukwila, WA, then flows northwesterly for approximately 21 km, bifurcating at the southern end of Harbor Island to form the East and West waterways prior to discharging into Elliott Bay. The project site is located within the Duwamish Waterway; i.e., that portion of the Duwamish River that is maintained by the Corps of Engineers (Corps) as a federally-mandated navigation channel. Navigation depths maintained by the Corps generally range from -15 feet MLLW to -30 feet MLLW (Weston 1994).

The majority of shorelines within the Duwamish Waterway have been developed for industrial and commercial operations, as the waterway serves as a major shipping route for containerized and bulk cargo. Common shoreline features within this area include constructed bulkheads, with manmade structures such as piers, wharves and buildings extending over the water, and steeply sloped banks armored with riprap and/or other fill materials such as concrete slabs and miscellaneous debris. Intertidal habitats are dispersed in relatively small patches generally less than one acre in size, with the exception of Kellogg Island, which is the largest contiguous area of intertidal habitat remaining in the lower Duwamish River (Tanner 1991) (see Appendix B, figures 9 (far background), and 7 (far background, immediately right of stacked shipping containers).

The Duwamish/Green River system drains an area of approximately 483 square miles, with peak runoff occurring during winter rains, and low flow throughout late summer (Weston 1994). Stream flow for most of the Duwamish River is regulated by the Howard Hanson Dam upstream of the junction of the Green and Black Rivers. The Corps has limited peak discharges to 12K cfs at Tukwila, and minimum flows to as low as 200 cfs, with an average flow of 1.5K to 1.8K cfs.

Tidal effects have been observed throughout the entire reach of the Duwamish Waterway, resulting in characteristic estuarine stratification of the river. Surface water is generally fresh or brackish; the bottom of the water column is more saline. This bottom layer, or "salt wedge", oscillates with the river based on river flow volume and tidal stage, but tends to be persistent under low flow conditions combined with high tidal magnitude, being detected as far as 16 km upstream from the mouth (Weston 1994).

Bottom sediment composition is variable throughout, at a minimum, the Duwamish River portion of the action area. Available historical surface sediment data suggest the presence of coarser sediments (e.g., medium and coarse sands) in nearshore areas adjacent to combined sewer overflow (CSO) and storm drain (SD) discharges and riprap or similarly constructed banks, as well as in subtidal (scour) areas in the vicinity of the bridges that cross the river[4]. Finer grained sediments (i.e., silts and clays) have generally been encountered in the remnant mudflats, along channel sideslopes, and within portions of the navigation channel.

Numerous past investigations within the Duwamish Waterway have been conducted with varying scopes. Some of the historical studies focused on specific land parcels, while the remaining studies were riverwide and incorporated sediment sampling as one of several components of the entire study. These past sediment studies have indicated that polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals (e.g. mercury), miscellaneous organic compounds (e.g., phthalate esters and chlorinated benzenes), pesticides, and organotins in river sediments at concentrations that may cause deleterious effects to humans and aquatic organisms. PCBs and bis(2-ethylhexy)phthalate appear to be the most widespread contaminants of potential concern, followed by metals[5] and PAHs. These contaminants may have entered the river via several transport pathways or mechanisms, including spillage during product shipping and handling, direct disposal or discharge, contaminated groundwater discharge, surface water runoff, stormwater discharge, or erosion of contaminated soils (Weston 1999).

Much of the upland areas adjacent to the Duwamish River portion of the action area, including the project site, are heavily industrialized: consequently, marine traffic is present throughout the Duwamish Waterway from RM 0.0 to RM 11.0. Historical and current commercial and industrial operations include cargo handling and storage; marine construction; boat manufacturing; maintenance and repair; marina operations; concrete and other stone material manufacturing and distribution; paper and metals fabrication; food processing; and airplane parts manufacturing. Additionally, this reach of the river is the receiving body for discharges from numerous municipal SDs and CSOs, as well as multiple privately held outfalls and drains.

The regional geology of the Seattle area is dominated by recent tectonics and Quaternary glaciations. Drift unconsolidated glacial materials and nonglacial deposits cover structurally deformed Tertiary bedrock comprising marine and estuarine sandstone, shale and conglomerate, in addition to basalt, andesite and volcaniclastic rocks. Drift units, separated by nonglacial sediments, from at least five major glaciations are recognized. The last glacier retreated from the Seattle area approximately 13,500 years BP. Each glaciation is characterized by a complex sequence of lacustrine deposits, advance outwash (river sediment), glaciomarine drift, till, and recessional outwash. The preservation of these deposits is patchy due to the erosion and deposition during the succeeding glacial and nonglacial intervals. The nonglacial intervals are represented typically by alluvial deposits (Galster and Laprade 1991).

[4]First Avenue South and 16th Avenue South.

[5]Primarily mercury and zinc.

The dominant post-glacial stratigraphy, which occupies relict subglacial meltwater channels scoured into advance outwash and older deposits during recession of the Puget lobe, consists of large, prograding river-mouth deltaic sequences that interfinger with marine embayment deposits. The Duwamish River valley is a relict trough and post-glacial ancient marine embayment, which has been filled with sediment in the past few thousand years by the prograding ancestral Duwamish river-mouth delta (Dragovitch et al. 1994).

The original topography of the lower Duwamish River has been modified. Prior to development of the Duwamish River valley, the land surface consisted of low-lying floodplains and tidal flats. Prior to 1918, the Duwamish meandered widely. Natural slips cutting into the riverbank today are the only evidence of the river system's original course. Between 1910 and 1920, the lower river was channelized to create the Duwamish Waterway. The former river channel and surrounding floodplains were filled and graded to form current topography.

In recent years, enforcement of the Clean Water Act (CWA) and subsequent State of Washington water quality standards (WAC 173-201), and implementation of the National Pollutant Discharge Elimination System (NPDES), prohibitions against discharge of toxic or deleterious materials have markedly improved water quality conditions in the Green River and in the Duwamish estuary. Diversion of direct sewage discharges to treatment or to Puget Sound has greatly reduced the biological oxygen demand in the river and estuary. The combination of these controls of point-source discharges and increased compliance with point and non-point source discharge regulations and associated best management practices have greatly improved water quality conditions in the Duwamish. For example, the Pacific Marine Environmental Laboratory monitored the Duwamish River in 1981, 1985 and 1986, and showed dramatic decreases of copper, lead and zinc concentrations in the water. In 1986, dissolved lead discharges into the Duwamish River were only one percent of the amount discharged in 1981; dissolved copper and zinc discharges were only five and ten percent, respectively, of amounts discharged in 1981 (Metro, 1989).

In 1996, King County DNR (King County 2001) studied the existing conditions in the Duwamish, as well as the county's combined sewer overflows, and their effects on water quality in the Duwamish River using a risk assessment approach. The risk assessment considered several portions of the overall action area food web, including aquatic life, benthos, shorebirds, wading birds, raptors, mammals and humans. The study investigated several chemicals in water and in sediment, physical disturbances, and changes in salinity, dissolved oxygen, pH, and water temperature (King County 2001).

Overall, this water quality assessment (WQA) found minimal risks to aquatic life from chemicals in the water column, no risk of mortality to juvenile salmon from direct exposure to chemicals in the water, and no risk of mortality to salmon smolt from consuming amphipods in the Duwamish estuary. Specifically, the study discovered the following:

A. Risks to water column-dwelling organisms from exposure to chemicals of potential concern in the water of the Duwamish River and Elliott Bay appear to be minimal. Any potential risks are below the levels used by EPA to develop water quality criteria. These predicted risk levels were confirmed by the observed lack of chronic toxicity to sensitive organisms from undiluted effluent from the Brandon Street CSO.

B. There was no apparent risk of mortality to salmon from exposure to chemicals in the water column.

C. There was no apparent risk of mortality to salmon from concentrations of copper, lead, zinc, TBT or PCBs (Aroclors 1254 and 1260) in their prey. Other chemicals were not evaluated because of lack of appropriate data.

The project action area is currently listed in §303(d) of CWA (WDOE 2001). Action area water column parameters cited for this listing are (1) pH, (2) dissolved oxygen and (3) fecal coliform. Action area water temperature was not in exceedance of federal standards. It is important to note that there has been no comprehensive assessment of basin-wide water quality to determine which waterbody segments do or do not meet water quality standards. The water bodies on the 1998 303(d) list mostly reflect exceedances where water quality data have been collected. It should not be inferred that all other segments meet water quality standards. Some segments have been monitored regularly and meet water quality standards; however, other segments may exceed standards but are not on the 303(d) list because they have not been monitored. It is also important to note that Duwamish River sediments and tissues are also listed by 303(d) for numerous metals and organic chemicals.

Development of the next 303(d) list is required by April, 2002. Under the amended CWA, the list is now required to have four parts, but will be required every four years rather than every two years. The expanded list will include all evaluated waterbodies that show impairment. Part 1 listings will be prioritized and scheduled for implementing TMDLs. Part 2 listings will include impairments as a result of nonquantifiable pollution. Part 3 waterbodies will have existing TMDLs that are considered effective. Part 4 listings will be those segments expected to meet water quality standards due to enforceable controls by the next listing in 2006.

Upstream (i.e., Green River) sources contribute more than two thirds of the total volume of sediment, iron and mercury load that reaches the Duwamish estuary (Metro, 1989). Upstream sources may also be the primary origin of organic carbon and pesticides (Metro, 1989). Temperature, bacteria, nutrients and oxygen levels have historically created problems in the Duwamish River (Washington Department of Ecology (DOE) 1988). During conditions of low oxygen and/or increased temperature, the U. S. Army Corps of Engineers (Corps) has sometimes released more water from Howard Hanson Dam to create less limiting scenarios.

From 1970 to 1980, the Renton Treatment Plant contributed approximately 80 percent of the total ammonia load into the Duwamish River. However, in 1987, the Renton Treatment Plant diverted its outfall from the Duwamish to Elliott Bay. Since then, improvements in levels of ammonia, total phosphorous, dissolved oxygen, total nitrogen and residual chlorine have been documented (Metro, 1989). Low dissolved oxygen levels and resulting mortalities or delays in upstream migrations of chinook salmon, which used to occur frequently in the Duwamish, have not been reported since this diversion (Salo 1969; Grette and Salo 1986). However, agricultural and septic inputs still create sub-optimum oxygen levels during late summer, low flow, conditions. Also, increased temperatures and sediment inputs resulting from logging and sweeping residential and commercial development over the last 30 years have reduced the quality of habitats available for salmon spawning and rearing in the middle and upper watersheds (Kerwin and Nelson 2000).

Action area annual recorded maximum water temperatures from 1970-1998 are shown in Appendix H. Values represented by rectangles in this figure (Pentec 1999) were recorded at the sampling station closest to the project site. The standard for Class B marine waters (approximately 19°C) was exceeded at this sampling station once during this 28-year period (year=1995).

Residues from past industrial practices led to contamination of sediments in various portions of the action area. Passage of the Washington Sediment Management Act (SMA) and adoption of its implementing rules (WAC 173-204), and passage of the State Model Toxics Control Act (MTCA) have led to cleanups of some areas of contaminated sediments in the Duwamish Waterway and Elliott Bay; other cleanups are under evaluation. Other areas with past contamination by hydrocarbons are undergoing natural recovery through the processes of biodegradation and gradual burial by waterborne sediments.

EVS Environmental Consultants (EVS, 1997) compared sediment chemistry results between co-located stations sampled during two earlier studies in the Harbor Island area and the later Harbor Island Supplemental Remediation Investigation (SRI). The number of stations exceeding the SMA cleanup screening levels (CSL's) in the earlier studies was greater than the number of stations exceeding the CSL's in the SRI. This trend was interpreted as representative of a general decrease in chemical concentrations between the studies. However, in contrast to the other compounds, mercury showed a general increase in concentration between the earlier and later studies. This increase in mercury levels may reflect differences in the analytical methods used in the different studies.

A set of four high-resolution cores, sectioned into two-centimeter layers, were collected during the SRI and analyzed for mercury, PCB's, lead-210 and cesium-137 in conjunction with a natural recovery evaluation plan (EVS, 1997). In three of the four cores, mercury concentrations were highest at depths below the upper 10-cm mixing layer, indicating that more recent sediments are less contaminated than older sediments. In the core taken at station NR-04, located in the south end of the East Waterway, mercury concentrations failed to show any clear trends. Total PCB's showed increased concentration at greater depths in all four cores, again indicating reduced sediment contamination rates and a trend toward improving conditions.

When PCB contamination is present in sediment, concern exists that an anaerobic environment causes PCBs to be released. Details are not known.

Currently, U.S. EPA (Region 10) has proposed River Kilometers 2.5 - 10.8 (Duwamish Waterway) for listing in CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) NPL (National Priorities List) (EPA ID#: WA0002329803).

Nevertheless, in addition to documented improvements in water quality and sediment conditions over the last 25 years, there have been several passive and active trends that have led to improved littoral and deeper benthic habitat. Changing economic uses of the shorelines along the Duwamish Waterway over the years have resulted in several significant changes in disturbance and stresses experienced by fish using habitats along the waterway. Passive trends include elimination of industries with direct discharges of industrial wastes (e.g., sawdust, wood debris, rendering plant wastes, metal and concrete) that directly alter habitats. Such materials have been gradually buried or degraded to the point where they often provide some habitat functions. More active trends include continuing improvements in practices by remaining industries that have reduced or eliminated discharges of habitat-altering materials. Another trend that has been of significance in the lower waterway is the improved management of marina fueling activities and vessel wastewater in compliance with U.S. Coast Guard and DOE regulations.

Also, any development or redevelopment of properties along the waterfront or river shorelines must comply with the provisions of the Washington Hydraulics Code (WAC 220-110); activities that would require filling of wetlands or placement of fill in Waters of the State or Waters of the United States must comply with the Clean Water Act. As a result, unavoidable adverse impacts of any action on wetlands or aquatic resources must be mitigated, and such mitigation must result in no net loss of habitat.

The Duwamish River serves as a migratory route, nursery and osmoregulatory transition zone for several species of salmonids[6] (Weston 1998). Chinook and coho utilize Elliott Bay and the Duwamish estuary more extensively than any of the other species (Weston 1998). The runs are composed of native and hatchery-reared salmon as a result of the state hatchery program located on the Green River.

The Duwamish River is part of the traditional fishing grounds of the Muckleshoot and Suquamish Tribes. During seasonal adult migration runs, tribal members engage in a gillnet fishery for various commercially important salmonid species. For an illustration of this fishery, reference Appendix B, Figure 9. In the figure's background, a gillnet is being set (8/15/01). These stocks also receive pressure from recreational fishing, which is popular at various public access locations along the lower reaches of the river, as well as throughout central Puget Sound.

[6]*Oncorhynchus kisutch, O. tshawytscha, O. keta, O. gorbuscha, O. mykiss and O. clarki clarki.*

There is a diverse assemblage of avian species present within the lower Duwamish River estuary. Both resident and migratory species of shorebirds, waterfowl, seabirds, songbirds and raptors can be observed throughout much of the year. Piscivorous species recorded in the action area include kingfisher (*Ceryle alcyon*) and great blue heron (*Ardea herodias*). Raptors (Family Accipitridae) such as hawks (*Circus sp.; Buteo, sp.*), bald eagles (*Haliaeetus leucocephalus*) and ospreys (*Pandion haliaetus*) also reside and/or frequent the Duwamish corridor (Weston 1994). An active osprey nest located on the Birmingham Steel property was observed during a previous reconnaisance. It is also not uncommon to find bald eagles nesting in the underdeveloped open spaces or West Seattle parks. At a minimum, the action area serves as an adult and juvenile forage area.

Mammals such as river otters (*Lutra canadensis*) and muskrats (*Ondatra zibethica*) have been observed in the action area. Marine mammals, including harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are known to frequently forage in Elliott Bay and have been sighted in the Duwamish waterway (Weston 1994). Both species are classified by WDFW as state monitor species (Weston 1998).

Non-native plant and animal species are of concern to salmonid protection and recovery efforts in the action area because non-native species can potentially affect native species by (1) occupying similar niches (i.e., competing for food and habitat), (2) inhibiting reproduction, (3) interbreeding with extant species, (4) introducing parasites and pathogens and (5) modifying and/or eliminating habitat used by native species (Moyle et al. 1986). The Green/Duwamish basin has no program which routinely monitors for the presence of non-native species; rather, they are generally discovered as a result of other programs. For further information regarding non-native species, reference Appendix I (Kerwin and Nelson 2000) as well as the next-to-last paragraph of this section.

Kerwin and Nelson (2000) analyzed six habitat parameters (hydrology, sediment transport, hydromodification, riparian, fish passage and non-native species) by river reach.

Potential ecological implications from altered hydrology (i.e., operation of Howard Hanson Dam) include: (1) reduced spatial dimensions for rearing, (2) interference with upstream adult salmonid migration, (3) increased water temperatures, (4) decreased potential to create/sustain side channel habitat and (5) artificially stabilized river margin habitats.

Prior to construction of Howard Hanson Dam (1961), flows as high as 28K cfs were measured at the Auburn gauge (USGS 1996). Since dam construction, there has been a near-complete absence of flows above 12K cfs at Auburn, and the duration of flows between 3.5K and 9.0K cfs has practically doubled (Kerwin and Nelson 2000)

Flow regime aspects have relevance for habitat protection. Spence et al. (1996) found that "protection of salmonid habitats requires stream flow to fluctuate within the natural range of flows for the given location and season." Such a scenario is in direct contrast to current WA legal requirements, which rely on establishment of minimum instream flows as the sole flow-related requirement for fish habitat protection. Spence et al. (1996) suggest that all aspects of the flow regime should be evaluated in examining hydrologic factors of decline for natural salmonid production in the Pacific Northwest. The proposed project will not affect flow regimes in the action area. A comprehensive conservation/recovery plan for WRIA 9 is expected to be approved by NMFS and USFWS by 2005 (Kerwin and Nelson 2000).

A synopsis of sediment transport and deposition throughout the action area is not available for this review.

Six types of hydromodifications are known to have affected the Green River basin: (1) changes in channel type and total length of mainstem channel, (2) bank armoring and artificial channel constraints, (3) reduced size and frequency of instream large woody debris (LWD), (4) changes in the extent of active gravel bars, (5) loss of off-channel habitats and (6) disrupted floodplain connectivity/function (Kerwin and Nelson 2000). Specific hydromodifications in the action area (RM 0.0 - RM 11.0) include:

- Diversion of the White and Cedar/Black Rivers from the Green/Duwamish River has reduced the freshwater inflow to the estuary by approximately two-thirds and has led (cf. historical conditions) to profound changes in the nature of the mainstem channel and adjacent floodplain.
- Creation of the Duwamish Waterway resulted in replacement of about 9.3 miles of meandering river with 5.3 miles of straightened channel.
- Approximately 98 percent (2.2 mi.^{2}) of the Duwamish's historic floodplain marshes and intertidal mudflats have been replaced with fill, overwater structures, commercial and industrial facilities and other development.
- A large proportion of the shoreline downstream of RM 5.3 and around Elliott Bay has been armored in some way; additionally, much of this shoreline is altered by the presence of overwater piers and wharves.
- Despite the alterations of the past ~100 years, patches of mudflats remain in the Duwamish River and Elliott Bay. These mudflats provide measurable and important estuarine rearing functions for juvenile salmonids.
- Recent habitat management policies and site specific restoration projects, as well as implementation of mitigation requirements for new habitat losses, have begun to address the degraded conditions in the action area.

Specific descriptions of effects of hydromodifications in the action area are found in Kerwin and Nelson (2000), pages 2.3-27 through 2.3-31.

Projects designed to add and improve shallow water habitat available for juvenile salmonids, flatfish, waterfowl, shorebirds, etc., have been initiated along the Duwamish and Green Rivers and around Elliott Bay. At this point in time, natural resource damage assessment (NRDA) restoration is being conducted under a consent decree among EPA, the City of Seattle and King County. Briefly, the Elliott Bay/Duwamish River Restoration Program (EB/DRRP) was established to implement the sediment remediation, habitat development, and source control provisions of that settlement. It is anticipated that future settlements from the assessment process being conducted by EPA as well as other Trustee efforts[7] will result in additional NRDA restoration projects in the Elliott Bay environment. Currently, EPA lists the following restoration project sites as active:

A. Hamm Creek Intertidal. Historically, Hamm Creek meandered through an intertidal marsh, then flowed into the mainstem Duwamish. From the early 1950s through 1971, the site was used for dredge disposal/stockpiling. Consequently, the creek was placed in a ditch and routed through a culvert with an outfall only accessible to fish at higher tides.

B. Herring's House Intertidal. Located near RM 2.0, at the site of the former Seaboard Lumber Mill. This facility operated from 1929 through the early 1980s. It is in the vicinity of Kellogg Island and on the last remaining 'oxbow' of the Duwamish. This area had been filled with material containing silt, and sand/gravel mixtures with broken asphalt, rock, concrete, brick, wood and metal debris. Investigations have revealed soils contaminated with TPH, lead, mercury, and PAHs which exceeded WA Model Toxics Control Act criteria. This site is located on the west bank of the Duwamish, roughly opposite the site of the proposed project.

C. Elliott Bay Nearshore Project. Descriptive information is missing.

D. North Wind's Weir. This location is approximately one mile upstream from Turning Basin #3. Poorly protected by riprap and debris in the low intertidal stages, a 1.03 acre intertidal basin will be constructed based on a 'softer' engineering approach. Habitat diversity will be maximized at the intertidal zone edge, and will be accompanied by upland park improvements.

E. Turning Basin #3. At this site, approximately RM 11.0, the Duwamish River becomes the Duwamish waterway. Proposed restoration project elements include: (A) daylight intertidal and subtidal areaa by removing vessels, (B) reduce pollution potential by curtailing commercial activity, (C) remove upland and inwater structures and (D) recontour banks to form three intertidal and supratidal habitat benches.

Additional demand for similar restoration/compensatory mitigation project sites is growing. It is thus likely that a substantial number of these projects will be completed in the near future, and increasing the quality of habitats available for juvenile salmonids.

[7]Trustees of the NRDA process include (1) NOAA, (2) U.S. Dept. of the Interior, (3) U.S. Fish and Wildlife Service, (4) U.S. Bureau of Indian Affairs, (5) WA Dept. of Ecology and (6) Suquamish and Muckleshoot Indian Tribes.

The fourth (of six) action area habitat parameters analyzed by Kerwin and Nelson (2000) is "riparian condition". These functions include (1) bank stabilization, (2) supply of organic matter and nutrients, (3) shade, (4) recruitment of LWD, (5) filtration of sediment, (6) channel migration zones and (7) microclimate(s). Current riparian condition was assessed based on vegetation type, size and density, generally corresponding with the methodologies recommended by the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) and WA State Forest Practices Board Manual (WFPB 1997). Existing data were used whenever possible. If riparian data could not be located, an original assessment was conducted specifically by Kerwin and Nelson (2000). The length of river with an "intact" riparian zone and the length of channel bordered by vegetation similar to the potential natural community was estimated. For purposes of this report, an "intact" riparian zone was defined as a horizontal segment of the 300 foot wide analysis area extending from each bank that contained no roads, houses or other buildings, yards, grass or agricultural fields, regardless of vegetation type.

Appendix K(Summary of Action Area Riparian Parameters) (Kerwin and Nelson 2000) provides details of the seven functions listed in the preceding paragraph for the project action area.

The sixth habitat parameter analyzed by Kerwin and Nelson (2000) is fish passage. The action area is primarily a deepwater channel maintained for navigation. Other than regulated instream flows and their potential temperature abnormalities, there are no known impassible barriers to fish passage in the action area. Dams constructed in the upper Green River subwatershed have had the most significant adverse impact on WRIA 9 migratory salmonid species. During the 1970s and 1980s, water quality barriers, associated with the processing of sewage in Renton, WA, occurred regularly and adult chinook kills were reported (LeVander 1999).

Non-native species is the seventh of seven habitat parameters discussed. Action area non-native species appear to be minimal. Atlantic salmon (*Salmo salar*) are known to have entered the action area, but there is no evidence they have propagated in the watershed. Non-native freshwater fish species would not tolerate salinities encountered adjacent to the project site. Warner and Fritz (1995) found fresh water at all depths and tides at RM 10.4, but salinities between 25 and 28 ppt were found at RM 7.5 at depths below 3 feet. Appendix L lists 38 species of non-native marine plant and invertebrate species found by the 1988 Puget Sound Expedition. Appendix M also summarizes recently enacted (2000) state legislation and rulemaking regarding more stringent management of ballast water by the shipping industry.

Based on the findings of Kerwin and Nelson (2000), data gaps necessary for maintaining a sufficient long term environmental baseline for WRIA 9, including the action area, currently include:

A. Spatial availability of water quality data.
B. Lack of continuous temperature data for some subbasins.
C. None or insufficient data for some parameters, chiefly water column levels of metals, pesticides, PAHs and phthalate esters. Most existing data is limited to sediment contents.
D. Lack of water quality baseline data for metals.
E. None or insufficient data on additive or synergistic effects. Synergism is the characteristic property of a mixture of toxicants that exhibits a greater-than-additive total toxic effect (U.S. EPA 1991).
F. Poor or insufficient data on aquatic insects.
G. Historic water quality limitations for salmonids.
H. Lack of reference stream site information. There is an interest in having reference sites based on different geomorphic systems to define background water quality conditions. Without reference sites, it is difficult to define the relative contribution of anthropogenic activities to degraded water quality conditions.

II.D.2 PROJECT SITE ENVIRONMENTAL BASELINE

The project site's land use has been zoned industrial by the City of Seattle. Kerwin and Nelson (2000) conclude that urban and land use practices (sic) constitute the principal limiting factor throughout the action area. Deteriorated habitat at the project site is the result of historically intensive industrial land use in the Duwamish Waterway.

Much of the baseline information presented in the preceding section (II.D.1) is applicable at the project site; for example:

- Tidal effects and resulting estuarine stratification
- Geology
- Water quality
- Bird and marine mammal assemblages
- Hydrology
- Sediment transport
- Hydromodification
- Riparian habitat
- Fish passage
- Non-native species

Figure 9 (Appendix B) is a photograph of the project site shoreline facing south, taken from an overwater ramp at project site. The taut cable in foreground is a barge mooring line. Ground upland of the concrete wall is covered with industrial buildings, pavement and gravel. No vegetation exists on upland area of project site (Moriarity 2001). The predominant existing intertidal vegetation appears to be *Fucus, sp.* At south end of project site, a band of grasses and deciduous vegetation is present; its habitat value has not been assessed. The bank slopes at a 1.5 to 1.0 rate to a depth of -25 feet MLLW.

Figure 10 (Appendix B) is a photograph of project site shoreline facing north, taken from an overwater ramp at project site. Upland characteristics, intertidal vegetation and bank slope are identical to those described above; however, riprap is absent to the north. Remnants of the horizontal vegetation band above MHHW persist. The conveyor belt is designed to minimize spillage.

Figure 8 (Appendix B) is a photograph taken from the shoreline, facing west. It illustrates a typical barge offloading operation. The supply barge is moored at project site dolphins (see also Appendix A, Figure 3). The main conveyer belt is at right; the overhead crane functions to raise/lower the outer receiving hopper to accomodate varying barge loads and tidal fluctuation. The overhead crane (white in color) on left functions to onload/offload the front end loader and main receiving hopper.

Appendix B (Figure 8) illustrates a portion of 15 existing steel and approximately 115 existing wooden pilings at the project site (Spearman 2001). Not counted are wooden pilings supporting a wharf to the north of proposed project boundary. The age of the steel pilings is eight years (Hoffman 2001). No maintenance or replacement of any piling on project site is proposed. Kozloff (1973) reports that, in the Puget Sound region, intertidal fauna associated with piling generally includes *Collisella digitalis*, *C. paradigitalis*, *C. pelta* (sometimes abundant), *Balanus glandula* and *Mytilus edulis*. The sea stars *Pisaster* and *Evasterias* may occasionally remain above the ebbing tide.

The objective of the proposed project is to remove approximately 600 cubic yards of material spilled at an intermodal transfer point along the shoreline of the Duwamish Waterway. The current configuration of the spilled material is shown in Appendix A, Figure 4 (Site Bathymetry). The chemical and physical properties of sixteen different grades of processed limestone are documented in Appendix N (Whittaker, Clark and Daniels, Inc. 2001).

III. EFFECTS OF THE ACTION

A. EFFECTS ANALYSIS:

The purpose of this section is to document the effects of subject proposal on federally listed species. Table III.1 presents the project site environmental baseline matrix of pathways and indicators.

Table III.I - Checklist for Documenting Baseline and Effects of Proposed Action(s) on Relevant Indicators

PATHWAYS/ INDICATORS	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTION(S)		
	Properly[1] Functioning	At Risk[1]	Not Properly[1] Functioning	Restore[2]	Maintain[3]	Degrade[4]
Water Quality: · Temperature	X				X	
Sediment			X		X	
Chem. Contam./Nut.			X		X	
Habitat Access: · Physical Barriers	X				X	
Habitat Elements: · Substrate			X		X	
Large Woody Debris N/A						
Pool Frequency N/A						
Pool Quality N/A						
Off-Channel Habitat			X		X	
Refugia			X		X	
Channel Condition & Dyn: · Width/Depth Ratio N/A						
Streambank Condition			X		X	
Floodplain Connectivity N/A						
Flow/Hydrology: · Peak/Base Flows N/A						
Drainage Network N/A						
Watershed Conditions: · Road Dens. & Loc. N/A						
Disturbance History			X		X	
Riparian Reserves		X			X	

Watershed Name: **WRIA 9** Location: **Duwamish Waterway**

1These three categories of function "properly functioning," "at risk," and "not properly functioning" are defined for each indicator in the "Matrix of Pathways and Indicators" Table 1 on p. 10, NMFS 1999.

2For the purposes of this checklist, "restore" means to change the function of an "at risk" indicator to "properly functioning" or to change the function of a "not properly functioning" indicator to "at risk" or "properly functioning" i.e., it does not apply to "properly functioning" indicators.

3For the purposes of this checklist, "maintain" means that the function of an indicator does not change i.e., it applies to all indicators regardless of functional level.

4For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse i.e., it applies to all indicators regardless of functional level.

In some cases, a "not properly functioning" indicator may be further worsened, and this should be noted.

"Harm" is defined in 50 CFR 222.212 (64 Federal Register Number 215) as "an act which actually kills or injures fish or wildlife ... Such an act may include significant habitat modification or degradation which actually kills fish or wildlife by significantly impairing essential behavior patterns[8]. In addition to "harm", the other components of take are "Harass, pursue, hunt, shoot, wound, kill, trap, collect and capture."

Section 222.212 of Title 50 identifies ten specific types of activities and actions which constitute "harm". These actions, along with comments specific to proposed action, follow in Table III.2 below.

TABLE III.2
Relationship of proposed project to 50 CFR 222.212 ("Harm")

ACTION	COMMENT
Barriers	This project does not propose to construct or maintain barriers that eliminate or impede listed species' access to habitat or ability to migrate.
Pollutants	This project does not propose to discharge pollutants such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens or organic nutrient-laden water (including sewage) into listed species' habitat.
Feed Biota	This project does not propose to remove, poison or contaminate plants, fish, wildlife or other biota required by listed species for feeding or other essential behavior patterns.
Habitat Structure	This project does not propose to remove or alter rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and functions of a listed species' habitat.
Flow	This project does not propose to withdraw water or otherwise alter stream flow; i.e., impair essential behavior patterns of listed species.
Non-indigenous species	This project does not propose to release, either directly or indirectly, nonnative or artificially propagated species into action area.
Passage facilities	This project does not propose to construct or operate dams or water diversion structures with inadequate fish screens or fish passage facilities.
Unstable banks	This project does not propose to construct, maintain or use inadequate bridges, roads or trails on streambanks or unstable hill slopes adjacent to or above listed species' habitat(s).
Sediment input	This project does not propose conducting timber harvest, grazing, mining or other operations which result in substantially increased sediment input into aquatic habitat.
Riparian erosion	The project does not propose to conduct logging, grazing, farming, road construction or similar activities which have the potential to disturb soil and increase sediment delivery to the Duwamish Waterway.

[8]Breeding, spawning, rearing, migrating, feeding and sheltering.

The proposed project avoids the impacts described in the preceeding table ("Harm") by not including any of the prohibited actions in the project scope.

The design of the proposed project minimizes the following unavoidable impacts by means of Best Management Practices (BMPs): Reference Section I.B.4.a.i.

The design of the proposed project includes the following elements which enhance and/or restore biological function at the project site as well as contribute meaningfully to larger scale biological recovery in the Duwamish Waterway: N/A

Project effects on listed species and, where applicable, critical habitat are as follows.

III.A.1 Effect on Chinook Salmon:

The proposed material removal will cause temporary and localized impacts to water quality in the vicinity of the operating bucket dredge. The proposed project will affect localized water quality conditions in daylight hours only for a maximum of two days. Turbidity will be elevated and dissolved oxygen may be reduced.

Potential impact of dredging-induced resuspended sediment in the water column on juvenile salmonids is most closely described by LeGore and DesVoigne (1973). They performed a 96-hour bioassay on juvenile coho involving resuspended Duwamish substrate from river miles 1-2. The suspended material had no acute effect. Doses of up to 5% wet weight (28.8 g/liter dry weight basis) were used. No observable effect on the fish of contaminants released by the sediments was elicited, although high levels of those contaminants, such as volatile solids, chemical oxygen demand, organic nitrogen, oil and grease, zinc and lead, were present. Other research performed has limited applicability to salmonids, and its results are particularly difficult to interpret given the unique field conditions of this action area.

The project would have no effect on sediment sources or sedimentation rates. Resuspended sediments are not expected to adversely impact chinook salmon, particularly because (1) handling potentially contaminated sediments will not be attempted during the project and (2) WDFW project timing restrictions prohibit in-water work when juvenile and adult chinook salmon are present in the action area. In addition, the material to be recovered will be dewatered and recycled; consequently, there will be no need for either upland or submerged dumping.

This proposal's major impact on chinook critical habitat will be to remove approximately 600 cubic yards of spilled material, as described in Section I.B of this report, from substrate below material transfer point (barge to upland conveyor belt).

The proposed project may affect, but is not likely to adversely affect, chinook salmon. As proposed, project elements will not result in take (harm, harassment, etc.) of chinook salmon individuals or populations. The project will not jeopardize the continued existence of *O. tshawytscha*, nor result in adverse impacts to its designated critical habitat.

III.A.2 Effect on Steller Sea Lion: The closest consistently used haulout area to the project site is Race Rocks in the Strait of Juan de Fuca. The closest breeding rookeries are located at (1) the northern end of Vancouver Island, Canada, and (2) the southern portion of Oregon (Norberg, 1999) Steller sea lions have not been documented utilizing urbanized, contaminated embayments of Washington's inland waters such as Elliott Bay with any regularity; individuals are unlikely to use aquatic habitats in the Duwamish Waterway during any portion of their life histories.

The proposed project will have no effect on Steller sea lion individuals, populations or habitats.

III.A.3 Effect on Humpback Whale: Since this species is predictably not present in the project action area on a year-round basis and has not been documented south of Admiralty Inlet (Norberg, 1999), the proposed project will have no effect, either directly or indirectly, on any individuals, populations, or their habitats.

III.A.4 Effect on leatherback sea turtle: Leatherback sea turtles do not nest on beaches under U.S. jurisdiction, and the primary reasons for their decline are associated with adverse effects which occur significant distances from the action area. The species is not known to occur within the action area; therefore, the proposed project will have no effect.

III.A.5 Effect on coho salmon: Migration, rearing and feeding are the only documented essential behavior patterns of coho which occur in the vicinity of the project site. The proposed project will not affect outmigration, feeding or rearing because no in-water work is proposed during periods when coho are likely to be present in the action area. The proposed action will not further degrade the environmental baseline of the action area/project site, or hinder the attainment of properly functioning conditions at a spatial scale relevant to the Puget Sound/Strait of Georgia coho salmon ESU. Also, it will not appreciably reduce the functioning of existing degraded habitat. Consequently, the proposed project will not jeopardize the continued existence of coho populations within, nor potential metapopulations beyond, the boundaries of the ESU, or result in the destruction or adverse modification of its habitat.

III.A.6 Effect on Bull Trout: Bull trout are unlikely to be dependent on lower Duwamish River habitat because of its history of temperature elevation and contamination.

The proposed project may affect, but is not likely to adversely affect, individuals, populations or their habitats. Bull trout habitat issues of concern are temperature, habitat complexity, connectivity, and substrate composition/stability. Bull trout land management issues of concern are roads and floodplain/riparian protection (U.S. Fish and Wildlife Service, 1998). Proposed material removal would have no effect on temperature, habitat complexity, connectivity and substrate composition/stability. The proposal is independent of USFWS' priority land management issues and, therefore, will not affect them.

III.A.7 Effect on bald eagle: No existing bald eagle habitat will be destroyed or adversely impacted by this proposal. Bald eagles prefer mature coniferous trees and snags for nesting, roosting, and perching habitat. Mature, coniferous trees and snags are absent from the action area. It is unknown how often individuals from the Duwamish Head nest frequent the project site.

Minor short term impacts on bald eagles and their prey species may occur from proposed project elements; for example, due to the presence of motorized equipment (bucket dredge engine), fish, waterfowl, etc., which eagles may ordinarily consume on or in the vicinity of the project site may be displaced to other established eagle foraging sites within the action area. However, the size of action area-wide eagle populations would not likely diminish.

The front end loader which transfers material from supply barges to the conveyer belt system introduces approximately 64 decibels of background noise (Alfredson and May 1978) at the project site during barge offloading operations. This loader will not be operating during the proposed project. The bucket dredge engine is expected to generate a slightly higher noise level during project implementation.

The proposed project may affect, but is not likely to adversely affect, bald eagle individuals, populations or habitats.

III.B TAKE ANALYSIS

It has been demonstrated that the features of the proposed project will not harm (50 CFR 222.212) chinook salmon, bull trout or bald eagle. Harm is one of ten activities which ESA specifies as "take". The other nine are "harass, pursue, hunt, shoot, wound, kill, trap, collect and capture." This project, in addition to not harming listed species, proposes none of the other nine specified activities. Therefore, it does not constitute a take of any kind under any definition of law.

III.C INDIRECT / INTERRELATED / INTERDEPENDENT EFFECTS

There are no anticipated increases in future tonnage, capacity, propulsion or size of material delivery vessels (barges).

State and federal salmon recovery plans will be approved during the coming years. Changes that may be made by the City of Seattle and King County regarding future land uses throughout the lower Duwamish are unknown.

The proposed project will not interfere with ongoing salmon habitat restoration projects in the action area.

Because the recovered material will be dewatered and recycled into the raw material stream by Ash Grove Cement Company, the need for its offsite disposal is eliminated.

III.D CONSERVATION MEASURES

The proposed project has been designed to comply with all federal, state, and local requirements, including those of the Department of the Army, Department of Commerce, Department of the Interior, Washington Department of Fish and Wildlife, Washington Department of Ecology, and City of Seattle. It is a maintenance project in a highly industrialized area of a major Pacific coast port. As such, elements of biological conservation including habitat enhancement and/or restoration are not priority items within its scoping elements nor currently practical given its location. However, as shown in Table III.1 (Checklist for Documenting Baseline and Effects of Proposed Action(s) on Relevant Indicators), project scoping elements will generally maintain the environmental baseline of the action area.

III.E DETERMINATION OF EFFECT

The proposed project may affect, but is not likely to adversely affect:

1. Chinook salmon
2. Bull trout
3. Coho salmon
4. Bald eagle

The proposed project will not effect ("no effect"):

1. Steller sea lion
2. Humpback whale
3. Leatherback sea turtle

Table III.3 summarizes effect of project features on listed species as of the date of submittal of this BE.

Table III.3 - Effect of Ash Grove Cement Company material recovery on Federally Listed Species

Species	May Affect, Not Likely to Adversely Affect	No Effect	Comment
Chinook salmon	X		
Steller sea lion		X	
Humpback whale		X	
Leatherback sea turtle		X	
Coho salmon	X		
Bull trout	X		
Bald eagle	X		

It is understood that "jeopardy" is determined on a case-by-case basis involving specific information on habitat conditions, and health and status of listed species. A set of NMFS guidelines will provide additional assistance in the determination of jeopardy. Nevertheless, to the greatest extent possible, this document has determined that the proposed project (1) is not likely to jeopardize the continued existence of a listed species, and (2) is not likely to destroy or adversely modify habitat of chinook salmon, coho salmon, bull trout or bald eagle, including federally designated critical habitat of chinook salmon.

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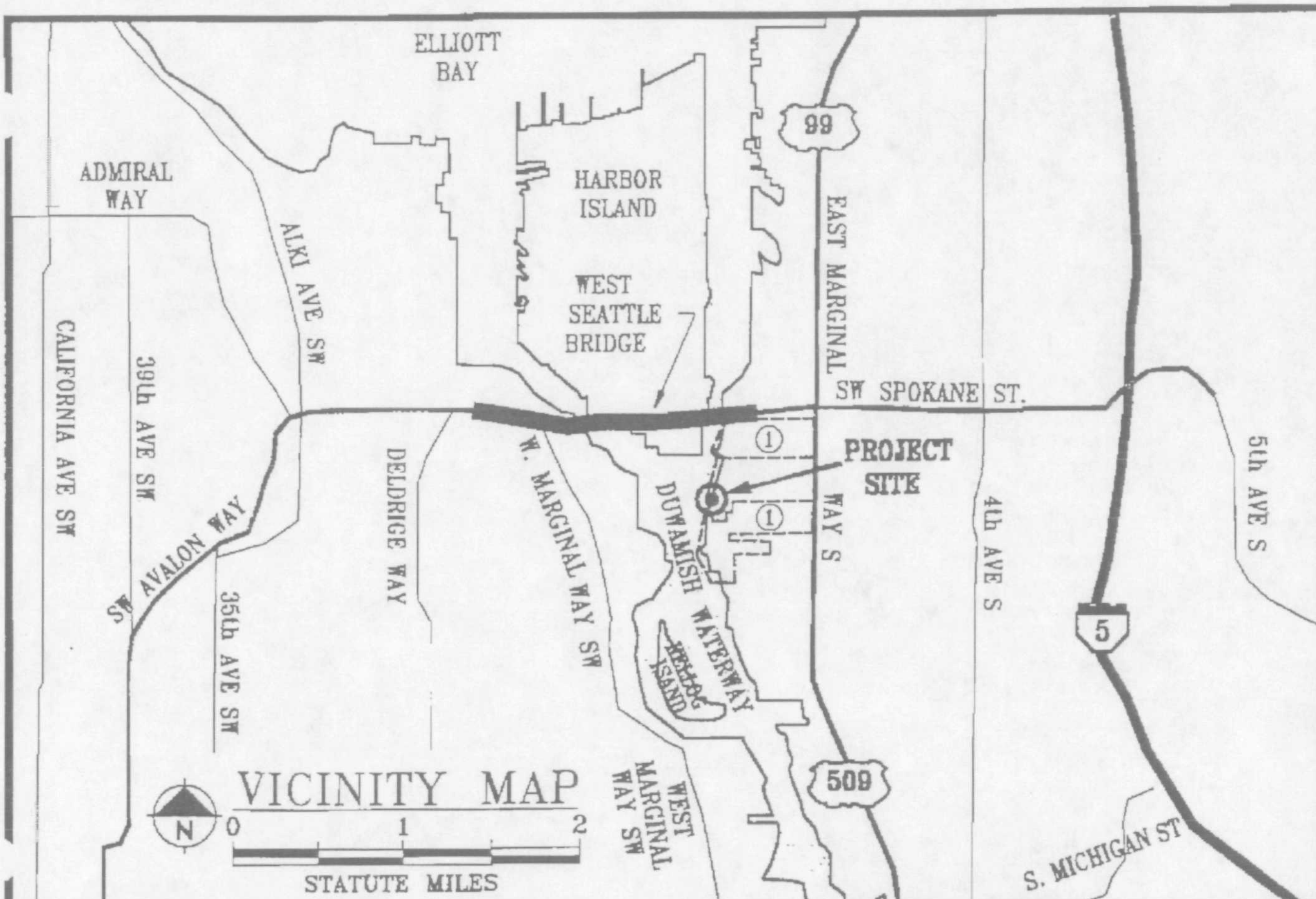
APPENDIX A:

PERMIT APPLICATION DRAWINGS



GENERAL NOTES:

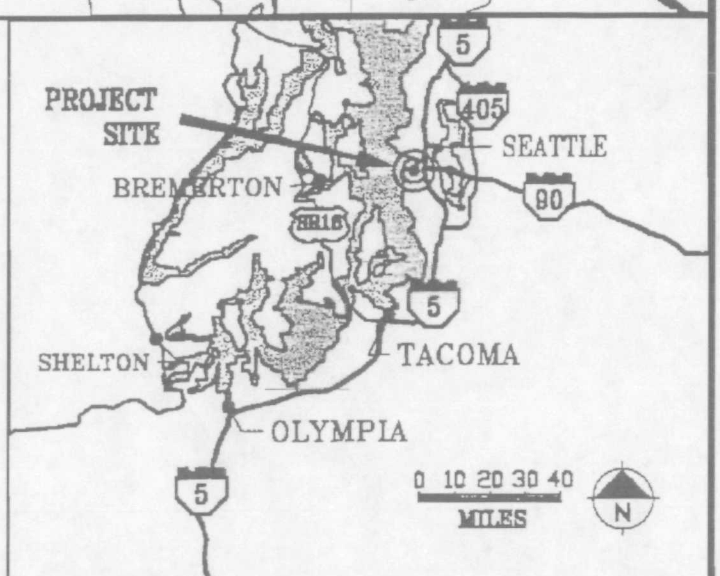
PROJECT ADDRESS:

3801 EAST MARGINAL WAY S.
SEATTLE, WASHINGTON 98134

LEGAL DESCRIPTION:

PARCEL B LOT 19 BLK 378
SEATTLE TIDELANDS AND
ADJACENT 1st CLASS TIDELANDS
LOCATED IN NE 1/4 OF SECTION
18, TOWNSHIP 24N, RANGE 4E WM

LATITUDE: 47° 34' 6.0"
LONGITUDE: 122° 20' 44.4"



Purpose: Remove Spilled Material from Vessel Berth
Datum: MLLW
Adjacent Property Owners:

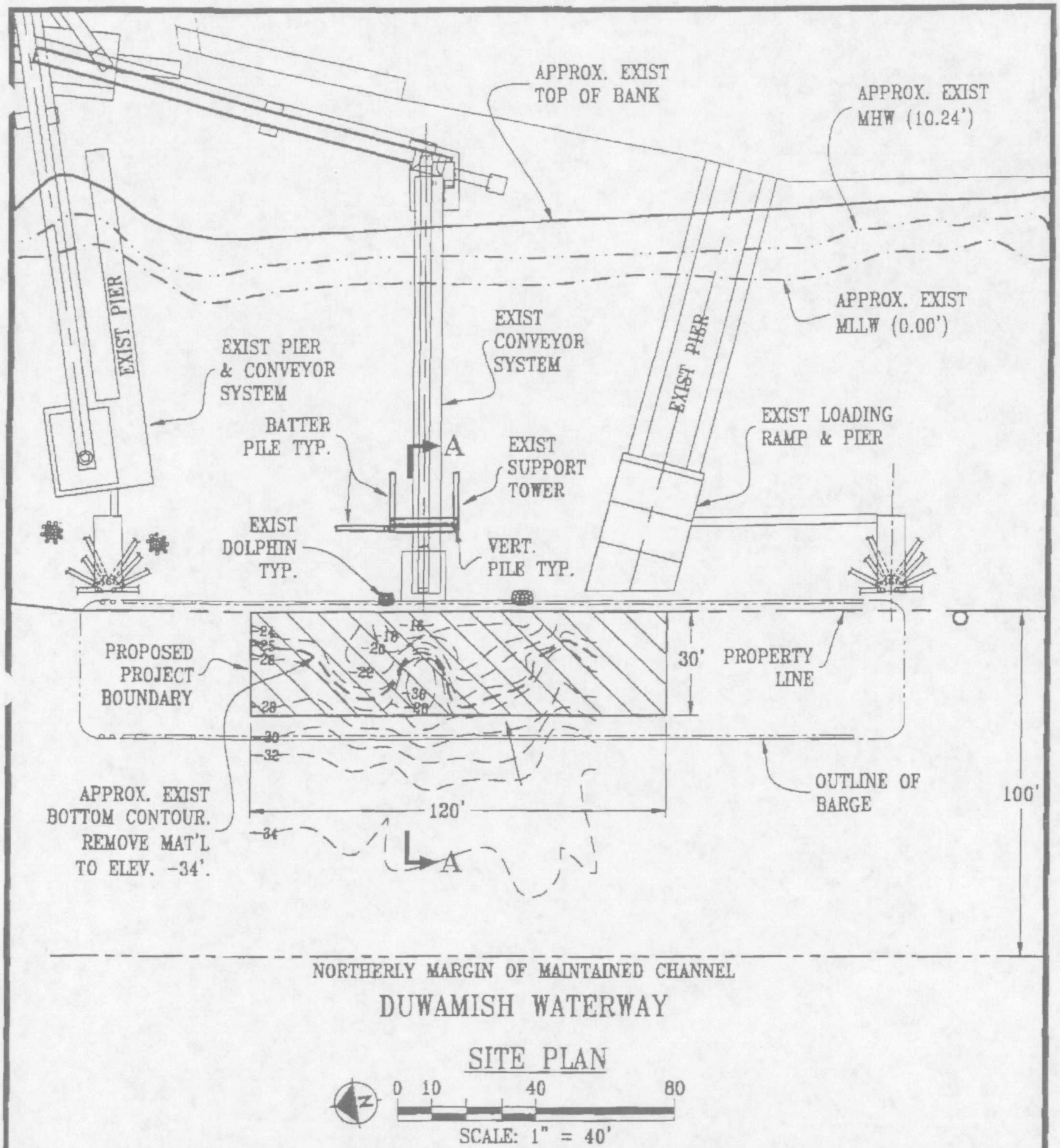
1) Port of Seattle

Reference: # 2001-1-00155
Proposed: In Water Material Recovery

In Duwamish Waterway
At Seattle, King County, Washington

Application by: Ash Grove Cement Co.
Sheet 1 of 3 Date: 8/28/2001

AGC2C000086



Purpose: Remove Spilled Material from Vessel Berth

Datum: MLLW

Adjacent Property Owners:

1) Port of Seattle

Reference: # 2001-1-00155

Proposed: In Water Material Recovery

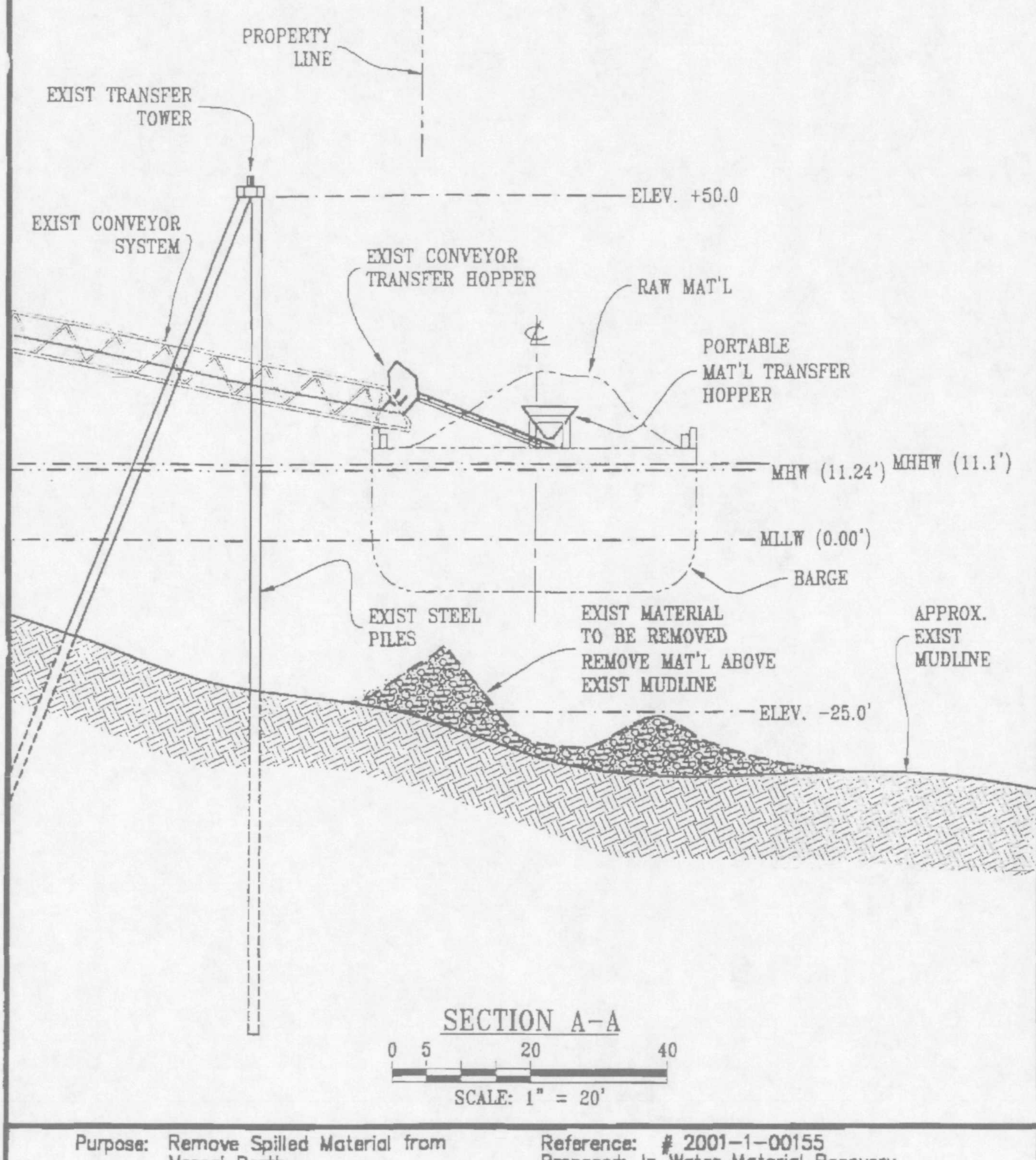
In Duwamish Waterway

At Seattle, King County, Washington

Application by: Ash Grove Cement Co.

Sheet 2 of 3 Date: 8/28/2001

AGC2C000087



Purpose: Remove Spilled Material from Vessel Berth
Datum: MLLW
Adjacent Property Owners:

1) Port of Seattle

Reference: # 2001-1-00155
Proposed: In Water Material Recovery
in Duwamish Waterway
At Seattle, King County, Washington
Application by: Ash Grove Cement Co.
Sheet 3 of 3 Date: 8/28/2001

APPENDIX B:

SITE PHOTOGRAPHS

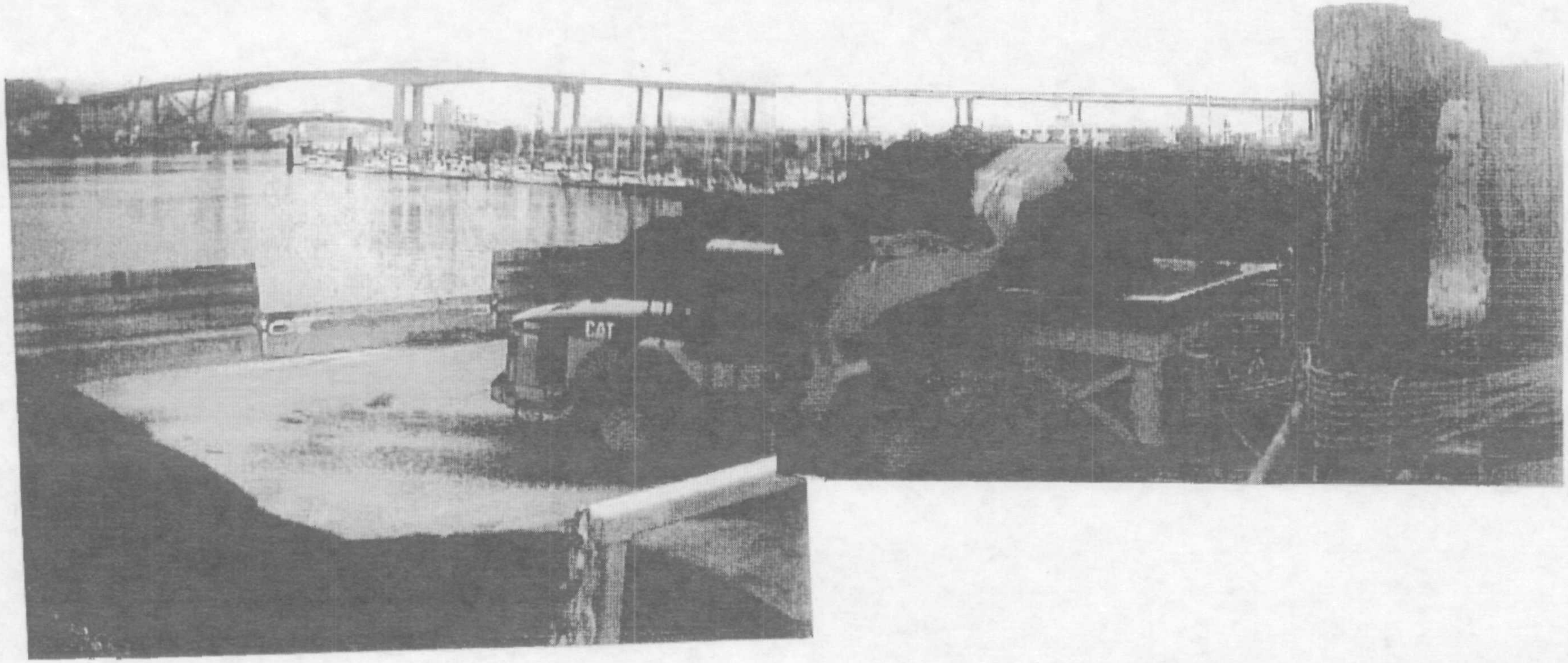


Figure 1 Loader on barge filling sand into portable first stage conveyor, which is feeding main conveyor hopper.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Jay W. Spearman

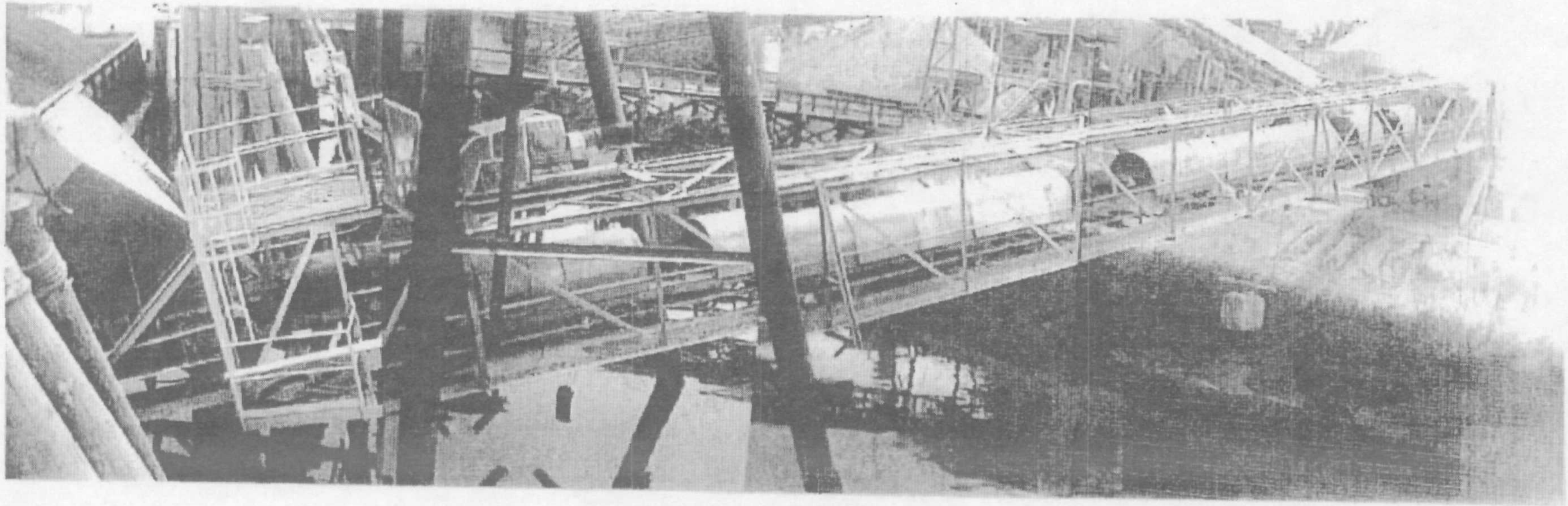


Figure 2 Main unloading conveyor. Hopper visible on left.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Jay W. Spearman

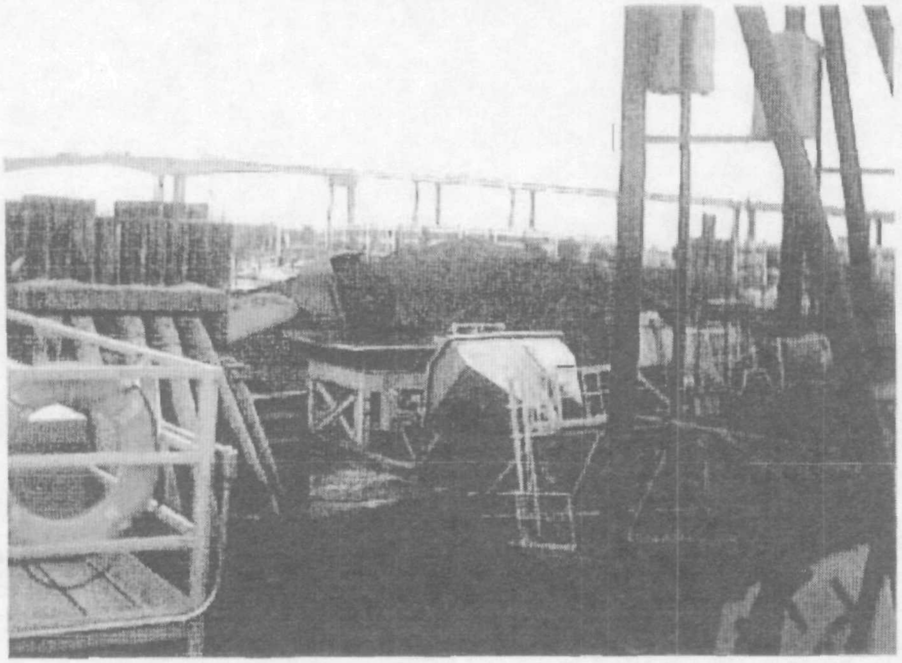


Figure 3 Loader feeding hopper of portable feed conveyor to hoppe of main conveyor.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Jay W. Spearman

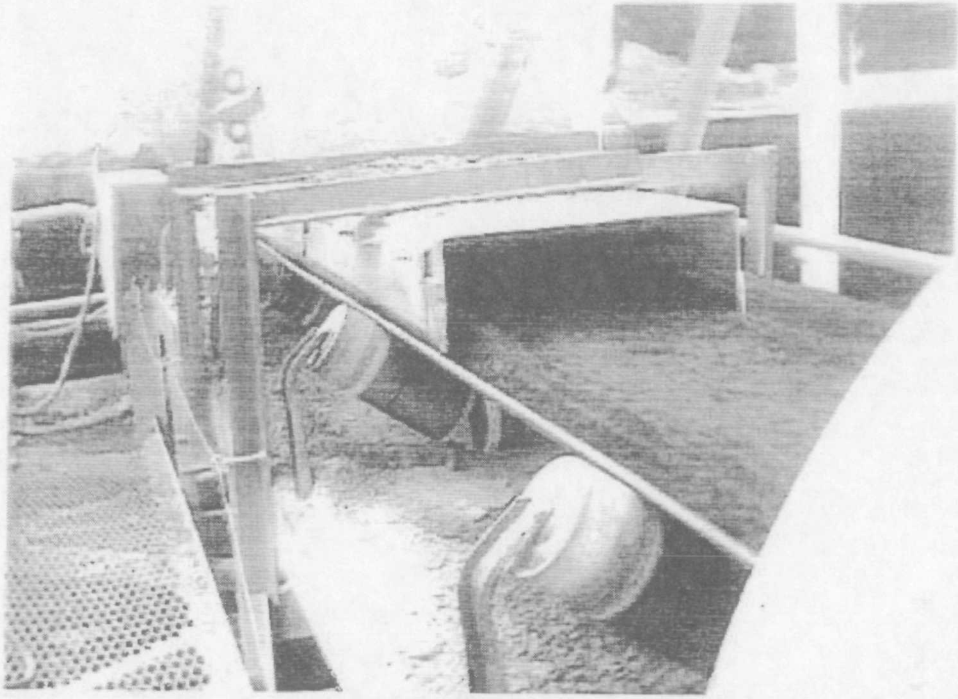


Figure 4 Guides feeding material from hopper on to main conveyor belt.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Jay W. Spearman

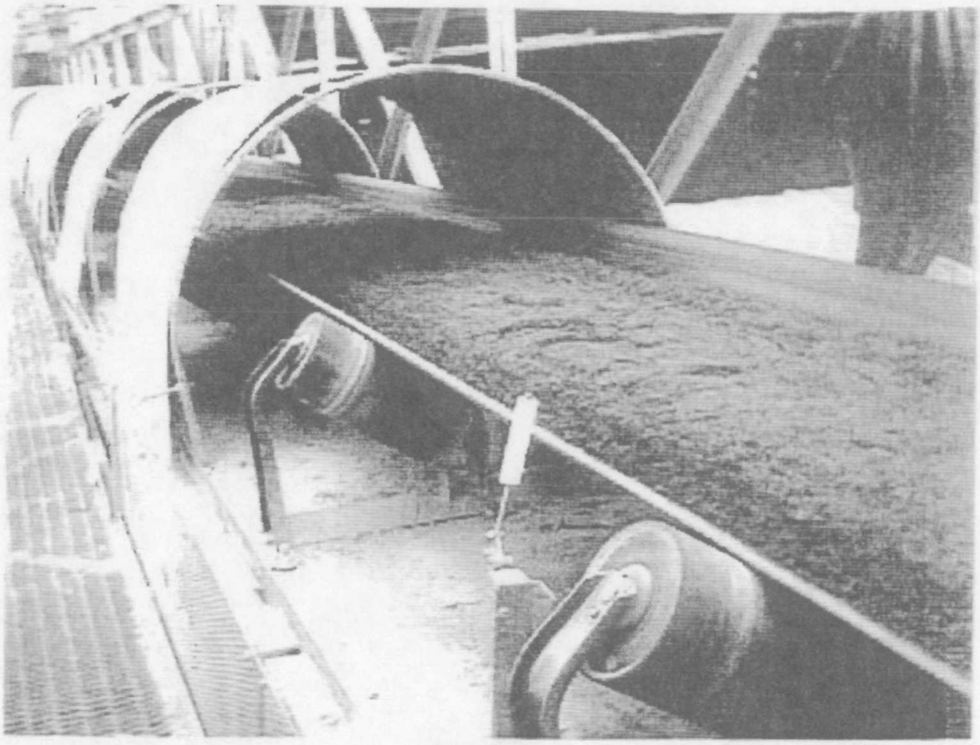


Figure 5 Typical conveyor belt with raw material. In this case, sand.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Jay W. Spearman

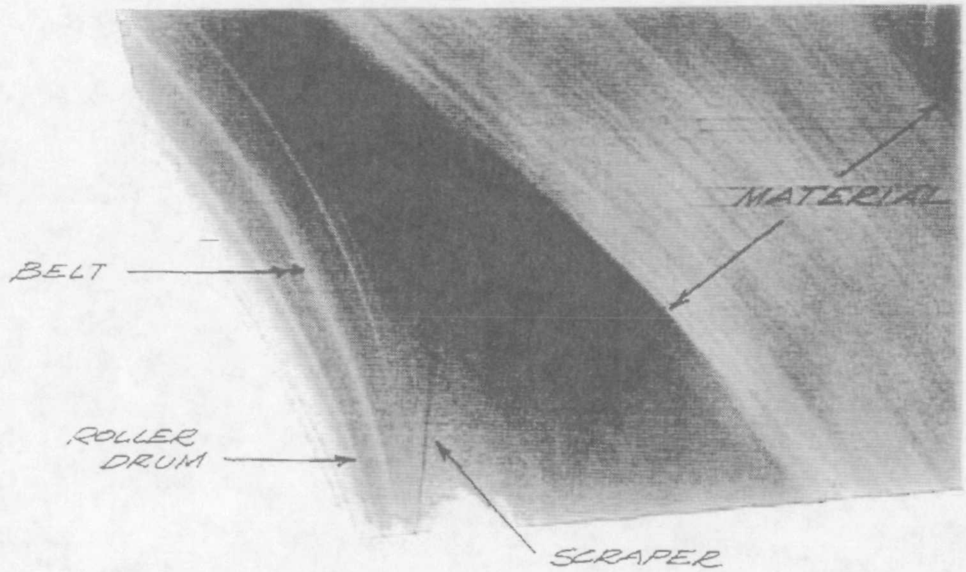


Figure 6 Belt scraper at top of main conveyor. Material spilling off to right, scraper cleaning belt center foreground.

Project: Ash Grove Cement Company

Date: 8/15/01

Taken by: Jay W. Spearman

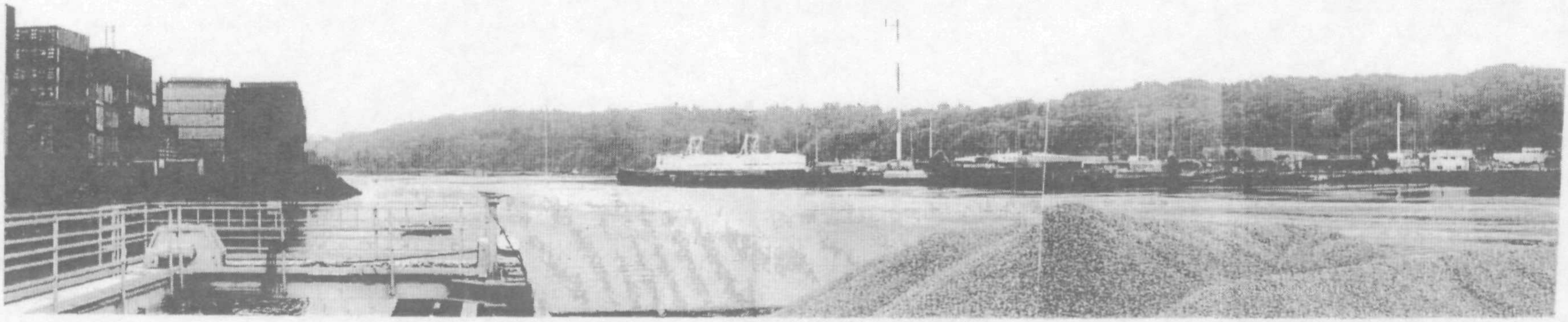


Figure 7 180° view of downstream portion of project action area, taken from shoreline at project site.
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Dan Moriarity

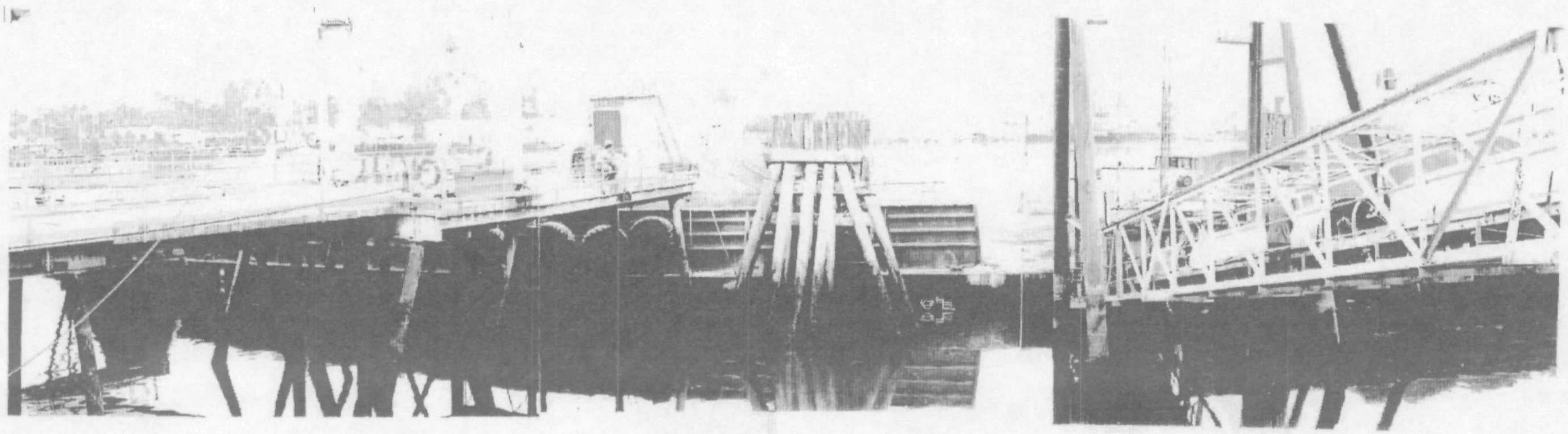


Figure 8 Supply barge moored to dolphins (off-loading in progress)
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Dan Moriarity

Figure 9 Shoreline upstream
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Dan Moriarity

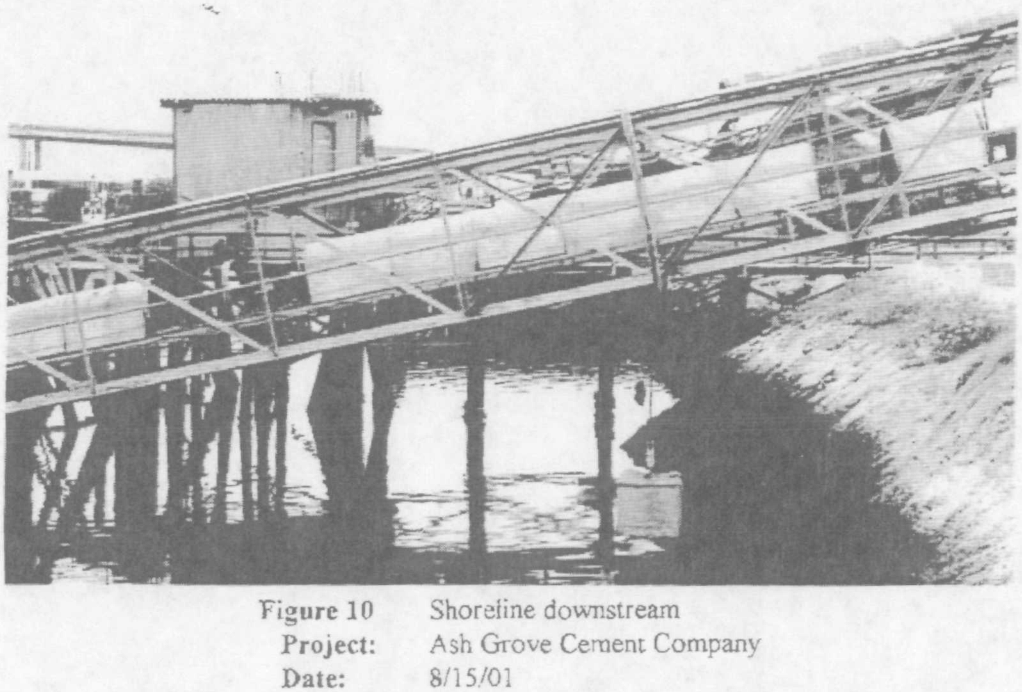


Figure 10 Shoreline downstream
Project: Ash Grove Cement Company
Date: 8/15/01
Taken by: Dan Moriarity

Appendix C:

USACE Letter of Notice for Project Permit Requirement

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

JUN 12 2001

Regulatory Branch

Spearman Engineering
ATTN: Jay W. Spearman, PE
Post Office Box 230
Bremerton, Washington 98337

Reference: 2001-1-00155
Spearman Engineering

Gentlemen:

Your request dated and faxed on February 6, 2001, inquired as to permit requirements for the recovery of processed material from the Duwamish River at the south tip of Harbor Island, Seattle, King County, Washington (drawing enclosed). A Department of the Army permit will be required for your proposed work.

Removal of the aggregate material from the bottom of Duwamish River waterway is considered dredging, even if the underlying sediments were not disturbed. Therefore, your proposal involves work in a navigable water of the United States, which is normally permitted under Section 10 of the Rivers and Harbors Act of 1899. This is reversal of our prior decision that a permit would not be needed for this work. This decision has come after discussion with my staff, the District's Office of Counsel, and other U.S. Army Corps of Engineers (Corps) districts.

Enclosed is permit application (JARPA). Please complete the application and provide drawings including (1) vicinity map -showing the location of the project site, (2) plan view – showing the area to be dredged, and (3) cross-section – showing the depth of the material to be remove.

Under the Corps Federal permit program, permit applications are reviewed for the potential impact on threatened and endangered species pursuant to Section 7 of the Endangered Species Act (ESA), as amended. The ESA requires that Federal agencies take action as necessary to ensure that they do not authorize, fund, or carry out actions that are likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for such species. The Corps, through consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), must evaluate information on the presence of listed species (including timing and life stages), habitat for such species or their prey sources, and other parameters.

As a result of the ESA listings, and the information requirements and consultation procedures discussed above, you must submit a Biological Evaluation/Assessment (BE/BA). We recommend that you have a qualified biologist with experience and/or strong understanding of the species of concern and their habitat as it relates to your project (i.e., marine or fresh water systems). Many consulting firms in the area have qualified biologists on staff that can prepare a BE/BA. Enclosed is a "Biological Evaluations" outline prepared by the Corps and a "Guide to Biological Assessments" developed by the NMFS to assist in the preparation of your BE/BA. You should be aware that we might have additional requests for information or changes to the BE/BA until there is sufficient information to satisfy the requirements of the NMFS and USFWS.

For a list of listed or proposed species present in your project area, contact:

U.S. Fish and Wildlife Service
Endangered Species Division
510 Desmond Drive Southeast, Suite 102
Lacey, WA 98503-1273
Telephone: (360) 753-9440
Website: http://endangered.fws.gov/index.html

National Marine Fisheries Service
Washington Habitat Conservation Branch
510 Desmond Drive Southeast, Suite 103
Lacey, WA 98503
Telephone: (360) 753-9530
Website: http://www.nwr.noaa.gov

In addition, Harbor Island has been listed on the National Priorities List for clean up under CERCLA (Superfund). This listing may affect work at the site, please contact Allison Hiltner with U.S. Environmental Protection Agency, Region 10.

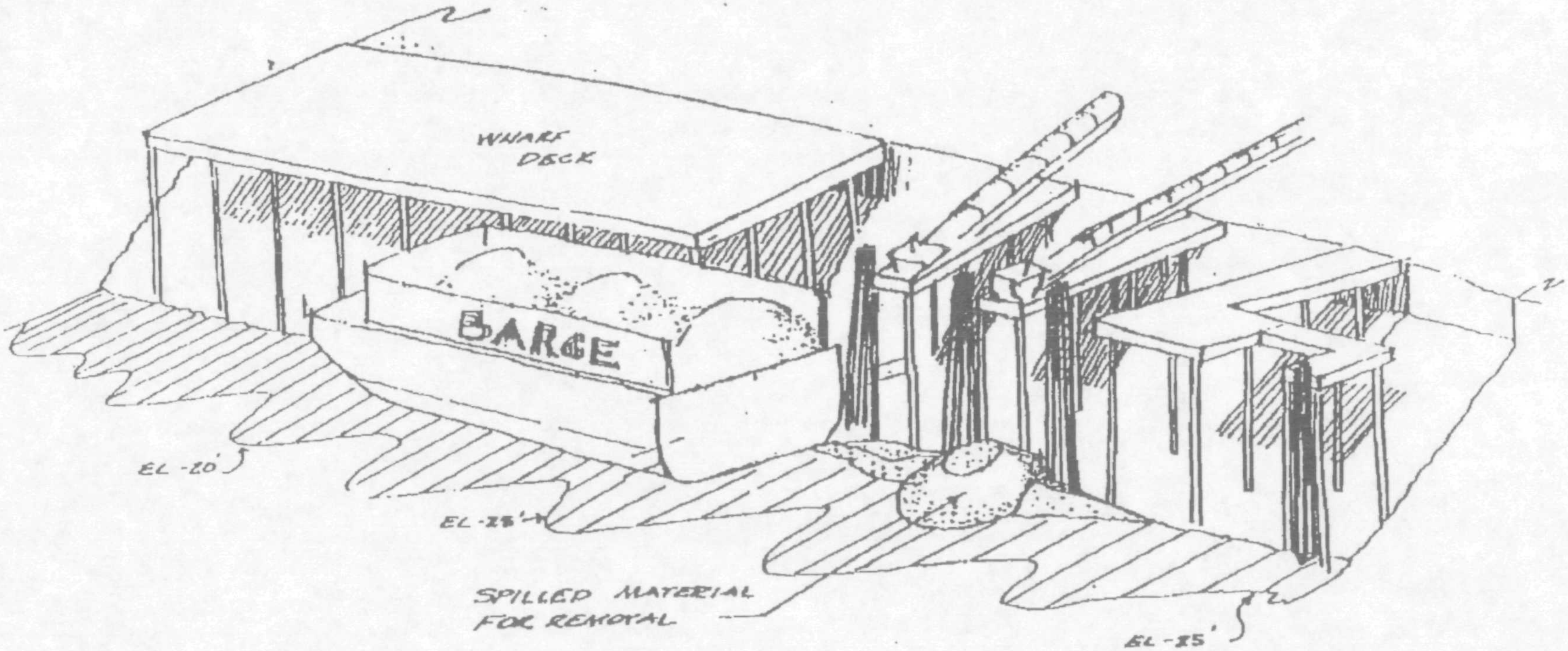
If you have any questions, please contact Ms. Olivia Romano, telephone (206) 764-6960.

Sincerely,

Ann R. Uhrich

Ann R. Uhrich
Chief, Application Review Section

Enclosures:



AGC2C000100

Proposed: Recover gravel
In: Duwamish River
At: Seattle
County of King State: WA
Application by: Ash Grove Cem
Sheet: 3 of 3
Date: 31 Dec 98

Appendix D:

Chinook Freshwater Phases in WRIA 9

Table 1. Green/Duwamish River Chinook Rearing Trajectories (WRIA 9).

Chinook Rearing Trajectory[1]	Abundance In Green/ Duwamish River[2]	Freshwater Rearing Duration[3]	Freshwater Rearing Season[4]	Estuarine Rearing Duration[3]	Estuarine Rearing Season[4]	Elliott Bay Shoreline Rearing Duration[3]	Elliott Bay Shoreline Rearing Season[4]
Emergent Fry (40<45 mm)	Uncommon	Days	Late February through March	Months	March to late May	Several Weeks to Months	May and June[5]
Fry/Fingerling (45-70 mm)	Present	Days to months	Late February to late April	Several days to months	Early April to late May	Several weeks to months	May and June[5]
Fingerling (>70 mm)	Abundant	Months	Late February to early June	Several days to two weeks	Late April to mid June	Several days to two weeks	May and June[5]
YEARLING	Uncommon	≈14 months	Year-round	Brief	—	—	—

[1]Defined based on timing of entrance to estuary.
[2]Based on Figures 1, 2, and 3.
[3]Individual residence.
[4]Population residence.
[5]Chinook are present in small numbers through July.

Source:
(Kerwin and Nelson 2000)

Appendix E:

Designated Critical Habitat for Steller Sea Lion

TITLE 50--WILDLIFE AND FISHERIES
DEPARTMENT OF COMMERCE

PART 226--DESIGNATED CRITICAL HABITAT

(226.202) Effective 1993

§ 226.202 Critical habitat for Stellar sea lions. Steller Sea Lion (Eumetopias jubatus)

(a) Alaska rookeries, haulouts, and associated areas.

In Alaska, all major Steller sea lion rookeries identified in Table 1 and major haulouts identified in Table 2 and associated terrestrial, air, and aquatic zones. Critical habitat includes a terrestrial zone that extends 3,000 feet (0.9 km) landward from the baseline or base point of each major rookery and major haulout in Alaska. Critical habitat includes an air zone that extends 3,000 feet (0.9 km) above the terrestrial zone of each major rookery and major haulout in Alaska, measured vertically from sea level. Critical habitat includes an aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is east of 144 deg. W. longitude. Critical habitat includes an aquatic zone that extends 20 nm (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is west of 144 deg. W. longitude.

(b) California and Oregon rookeries and associated areas.

In California and Oregon, all major Steller sea lion rookeries identified in Table 1 and associated air and aquatic zones. Critical habitat includes an air zone that extends 3,000 feet (0.9 km) above areas historically occupied by sea lions at each major rookery in California and Oregon, measured vertically from sea level. Critical habitat includes an aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery in California and Oregon.

(c) Three special aquatic foraging areas in Alaska.

Three special aquatic foraging areas in Alaska, including the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area.

(1) Critical habitat includes the Shelikof Strait area in the Gulf of Alaska and consists of
the area between the Alaska Peninsula and Tugidak, Sitkinak, Aiaktilik, Kodiak, Raspberry, Afognak and Shuyak Islands (connected by the shortest lines);
bounded on the west by a line connecting Cape Kumlik (56 deg.38"/157 deg.27'W) and the southwestern tip of Tugidak Island (56 deg.24'N/154 deg.41'W) and
bounded in the east by a line connecting Cape Douglas (58 deg.51'N/153 deg.15'W) and the northernmost tip of Shuyak Island (58 deg.37'N/152 deg.22'W).

(2) Critical habitat includes the Bogoslof area in the Bering Sea shelf and consists of the area
between 170 deg.00'W and 164 deg. 00'W,
south of straight lines connecting
55 deg. 00'N/170 deg.00'W and
55 deg.00'N/168 deg.00'W;
55 deg.30'N/168 deg.00'W and
55 deg.30'N/166 deg.00'W;
56 deg.00'N/166 deg.00'W and
56 deg.00'N/164 deg.00'W and
north of the Aleutian Islands and straight lines between the islands connecting the following coordinates in the order listed:
52 deg.49.2'N/169 deg.40.4'W
52 deg.49.8'N/169 deg.06.3'W
53 deg.23.8'N/167 deg.50.1'W
53 deg.18.7'N/167 deg.51.4'W
53 deg.59.0'N/166 deg.17.2'W
54 deg.02.9'N/166 deg.03.0'W
54 deg.07.7'N/165 deg.40.6'W
54 deg.08.9'N/165 deg.38.8'W
54 deg.11.9'N/165 deg.23.3'W
54 deg.23.9'N/164 deg.44.0'W

(3) Critical habitat includes the Seguam Pass area and consists of the area
between 52 deg.00'N and 53 deg.00'N and
between 173 deg.30'W and 172 deg.30'W.

Appendix F:

USFWS Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

AUG 2 0 2001

Dear Species List Requester:

We are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us (U.S. Fish and Wildlife Service).

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., "major construction activity"), impacts to both listed and proposed species must be considered in a biological assessment (BA) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency's best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BA will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to adversely affect" determination, you should request our concurrence through the informal consultation process. For a "no effect" determination, we would appreciate receiving a copy for our information.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but recommended. Protection provided to these species now may preclude possible listing in the future.

For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service at (360) 753-9530 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Yvonne Dettlaff (360) 753-9582.

Sincerely,

John Gullinbury
for

Ken S. Berg, Manager
Western Washington Office

Enclosure(s)

ATTACHMENT A

August 16, 2001

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED ASH GROVE CEMENT COMPANY PROJECT IN KING COUNTY, WASHINGTON

(T24N R04E S19)

FWS REF: 1-3-01-TA-1975

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) occur in the vicinity of the project.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species,

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project, and

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

PROPOSED

None

CANDIDATE

None

CRITICAL HABITAT

None

SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site.

Beller's ground beetle (*Agonum belleri*)
California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Hatch's click beetle (*Eanus hatchi*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific fisher (*Martes pennanti pacifica*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Pacific lamprey (*Lampetra tridentata*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Valley silverspot (*Speyeria zerene bremeri*)
Western toad (*Bufo boreas*)
Yellow-billed cuckoo (*Coccyzus americanus*)
Aster curtus (white-top aster)

Appendix G:

Action Area Current Land Use and Cover
(Kerwin & Nelson 2000)

Land Use Appendix

Table LU13: Current Land Cover/Land Use for Green/Duwamish Estuary Sub-watershed

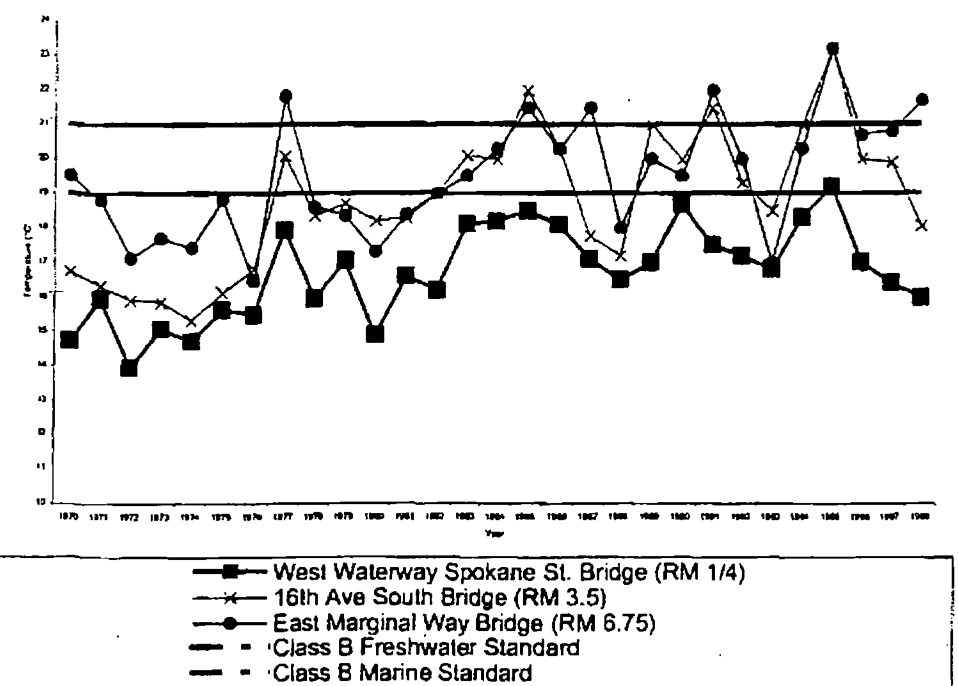
Land Cover Description	UGA (Sq. Mi.)	UGA (Acres)	Outside UGA (Sq.Mi.)	Outside UGA (Acres)	%of Sub-Watershed
Green/Duwamish Estuary Sub-watershed					
Industrial & Commercial	5.93	3,795.71	0.00	0.00	26.67%
Bare Rock/Concrete	0.25	163.08	0.00	0.00	1.15%
Conifer - Early	0.00	0.62	0.00	0.00	0.00%
Conifer - Mature	0.00	0.00	0.00	0.00	0.00%
Conifer - Middle	0.00	0.00	0.00	0.00	0.00%
Deciduous	1.57	1,003.87	0.00	0.00	7.05%
City Center, Industrial & Mining	3.52	2,252.86	0.00	0.00	15.83%
Low & Medium Density Residential	3.48	2,227.40	0.00	0.00	15.65%
High Density Residential	5.64	3,610.59	0.00	0.00	25.37%
Grass - Brown	0.71	457.22	0.00	0.00	3.21%
Grass - Green	0.39	247.38	0.00	0.00	1.74%
Mixed Forest	0.14	92.02	0.00	0.00	0.65%
Open Water	0.43	276.32	0.00	0.00	1.94%
Recently Cleared	0.03	16.37	0.00	0.00	0.12%
Scrub/Shrub	0.14	86.56	0.00	0.00	0.61%
Shadow	0.00	0.00	0.00	0.00	0.00%
Sub-Watershed Total	22.23	14,229.99		0.00	

Appendix H:

Annual Recorded Maximum Temperatures in the Duwamish River 1970 - 1998

(Kerwin & Nelson 2000)

Figure WQ-5. Annual Recorded Maximum Temperature in the Duwamish River, 1970-1998 (Pentec, 1999).



Appendix I:

Non-Native Species in Action Area
(Kerwin & Nelson 2000)

2.6 NON-NATIVE SPECIES

EXECUTIVE SUMMARY

Non-native plant and animal species are of concern to efforts to help protect and recover salmonids in the Green River Watershed, because non-native species can potentially affect native species by occupying similar ecological niches and competing for food and habitat; inhibiting reproduction; interbreeding with native species; being sources of parasites and pathogens; and even modifying, reducing, or eliminating habitat used by native species (Moyle et al. 1986). In the Green River Watershed, there is not a program that routinely monitors for non-native species, but rather they are discovered as a part of other programs. One exception, the Puget Sound Expedition, documented non-indigenous marine invertebrate and plant species in all of Puget Sound, including Elliot Bay. This survey found 38 non-native species in the sound, although it is not known what proportion of these species were found in Elliott Bay. Observations indicate that relatively few non-native fish species occur in Elliott Bay, the Green/Duwamish Estuary, or adjacent to the mainstem Green River upstream of tidal influence. Perhaps the most notable non-native fish species that sometimes occurs in the Green River is the adult Atlantic salmon (*Salmo salar*) that swim up the river after having escaped from the commercial net-pen fishery in Puget Sound. King County maintains a database of Atlantic salmon observations in the Green River (Nelson 2000).

Other non-native fish species other than salmonids that could potentially occur in the Green River include warmwater game fish that are found in several of the lakes that drain to tributaries of the Green River (WDFW 1999). These species include yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), smallmouth bass (*Micropterus dolomieui*), and largemouth bass (*Micropterus salmoides*). Although these warmwater game fish typically prefer waters which are relatively warm and slow moving several of these fish are occasionally observed in Soos Creek at the Soos Creek Fish Hatchery (Wilson 2000).

Relatively few non-native animal species other than fish potentially occur in or adjacent to the Green River. Nutria (*Myocastor coypus*), an aquatic mammal, is believed to occur in the Green River (Cassidy et al. 1997; Johnson and Cassidy 1997). Other non-native species that are potentially in the Green River include: the slider turtle (also known as the red-eared slider) (*Trachemys scripta*); snapping turtle (*Chelydra serpintina*); painted turtle (*Chrysemys picta*), which, although native to most of Washington state, is believed to have extended its range to the coast as a result of introductions (MELP 1998); spiny softshell turtle (*Apalone spiniferus*); bullfrog (*Rana catesbeiana*); green frog (*Rana clamitans*); Asian clam (*Corbicula fluminea*); and New Zealand mudsnail (*Potamopyrgus antidarium*). In addition to the species listed above, other non-native animals in and adjacent to the Green River include cattle, horses, and other livestock.

A number of non-native plant species are known to occur within the riparian zone of the Green/Duwamish estuary, the mainstem Green River, and its major tributaries. Of most concern along the river are a variety of non-native herbaceous and shrubby plants that tend to form dense colonies, which exclude the establishment of a more diverse or natural vegetative community. Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris* *arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*).

KEY FINDINGS

The key findings on non-native plants and animals in the Green/Duwamish estuary, mainstem Green River, and major tributaries are listed below:

- Although adult Atlantic salmon, which have escaped from the commercial net pen industry, occasionally swim into the estuary and up the Green River, no juvenile Atlantic salmon have been observed in the system.

- Non-native warmwater fish are known to be present in lakes that drain to the mainstem Green River, but observations of these fish in the river are limited.

- Nutria and bullfrogs are the only non-native aquatic animal species other than fish observed in the Green River watershed upstream of the tidally influenced zone.

- In the Green/Duwamish Estuary, three non-native benthic invertebrates are known to occur - the amphipod *Grandidierella japonica*, the tanaid *Sinelobus stanfordi*, and the cumacean *Nippoleucon hinumensis*.

- Some riparian areas are dominated by dense colonies of non-native vegetation, such as blackberry, reed canary grass, and Japanese knotweed.

DATA GAPS

- No program exists that routinely monitors for or documents the presence and location of non-native species in the Green River watershed.

- The overall implications of non-native species invasions are not well understood.

INTRODUCTION

Non-native species are organisms whose natural distribution did not originally include the area in which they are now found. Non-native species are also commonly referred to as non-native, non-indigenous, or introduced species. Sometimes they also are known as invasive species, alien species, or weeds. In WRIA 9 freshwater environment, non-native species identified to date include organisms that originated in Europe, Asia, and the eastern and southern regions of the American continents. For example, in North America, the Rocky Mountains are a physical barrier that naturally separates the ranges of many plants and animals. A species that is native to only the eastern United States is considered an non-native species when it occurs in the west, and conversely, many native western species are non-native in the eastern states.

Species can be introduced to areas outside their natural range through intentional transfers, movements through altered waterways (i.e., canals or diversions) or land cover (i.e., conversion of forest to pasture), and as a result of accidental or unintentional releases. In the Pacific

Both the snapping turtle and spiny softshell turtle are now found in Lake Washington (McAllister 2000). Although there is no documentation of sliders and painted turtles in WRIA 9, it is likely that they are present (McAllister 2000).

PLANTS

Several non-native plants are common and widespread throughout King County and are likely to be present in the Lower Green River subwatershed. A variety of non-native herbaceous and shrubby plants that tend to form dense colonies are known to occur along the river Species of particular concern include a variety of pasture grasses, reed canary grass (*Phalaris arundinacea*), Himalayan and evergreen blackberry (*Rubus discolor* and *R. laciniatus*), and Japanese knotweed (*Polygonum cuspidatum*). Two non-native plant species, blackberry and reed canarygrass, form a virtual biculture along the levees and revetments adjacent to the Lower Green River (Schaefer 2000).

GREEN/DUWAMISH ESTUARY

FISH

Adult Atlantic salmon that have escaped from marine net pens are known to occur in Elliott Bay and occasionally enter the Green/Duwamish Estuary, but there is no evidence that the species has propagated in the basin. With the exception of the occasional stray fish (e.g., barracuda), interviews with regional biologists indicate that there are no other known observations of non-native fish species in Elliott Bay or the Green/Duwamish Estuary (Cropp 2000; Geist 2000; Cordell 2000).

The potential freshwater non-natives discussed in previous sections would be limited to areas of the upper estuary. Warner and Fritz (1995) found fresh water at all depths and tides at RM 10.4, but salinities between 25 and 28 ppt were found at RM 7.5 at depths below 3 ft.

OTHER ANIMALS

Cordell (Cordell 2000) documented three non-native benthic invertebrates in the Green/Duwamish Estuary—the amphipod *Grandidierella japonica*, the tanaid *Sinelobus stanfordi*, and the cumacean *Nippoleucon hinumensis*. The Puget Sound Expedition, which documented non-indigenous marine invertebrate and plant species in all of Puget Sound, found 38 non-indigenous species in the sound as presented in Table 5.1.6-1. It is not known what proportion of these species were found in Elliott Bay. Non-native animals other than fish and invertebrates are not expected to occur in the Green/Duwamish Estuary or Elliott Bay area. The estuary and bay are highly developed and provide very little natural terrestrial or riparian habitat. The potential presence of nutria, bullfrog, and turtle species is diminished in the estuary because these species are common to freshwater habitats.

PLANTS

Several non-natives plant species are known to occur in the Green/Duwamish Estuary, including common reed (*Phragmites australis*), Himalayan blackberry (*Rubus discolor*), evergreen blackberry (*R. laciniatus*), Japanese knotweed (*Polygonum cuspidatum*), and reed canarygrass (*Phalaris arudinacea*). During a May 1999 field reconnaissance, Pentec Environmental found that blackberry shrubs (likely a mixture of *R. discolor* and *R. laciniatus*) were well established in the upper riparian zone of the estuary between RM 11.0 and RM 5.3. It is the most common shrub species present along the Duwamish River. Common reed has become well established in two locations in the Green/ Duwamish Estuary-Kellogg Island, located between RM 2.0 and RM 1.0, and the 509 marsh area located between RM 3.0 and RM 2.5. Other species of concern in the estuary include common tansy (*Tanacetum vulgare*), yellow iris (*Iris pseudacorus*), and Scots broom (*Cytisus scoparius*) (Dean 2000).

Appendix J:

Summary of Action Area Riparian Condition Functional Status

(Kerwin & Nelson 2000)

Table RIP-7. Summary of riparian condition functional status in the Duwamish Estuary and Elliott Bay.				
Function	**Good (miles/[%])**	**Fair (miles/[%])**	**Poor (miles/[%])**	**Comment**
Duwamish River RM 11.0 – 5.3 (both banks)				
Bank stability	NA	NA	NA	Actual bank stability driven by levees/revetments
Shade	0	4.0 (35.4)	7.4 (64.6)	Temperature moderation function less relevant in estuary than upstream
OM/terrestrial invertebrate recruitment	0	1.3 (11.6)	10.1 (88.4)	Invertebrate recruitment supplemented by tidal marsh vegetation in limited areas
Sediment filtration	0	1.3 (11.6)	10.1 (88.4)	Function in estuary less critical than in upstream areas
LWD recruitment	0	1.3 (11.6)	10.1 (88.4)	Function in estuary less critical than in upstream areas
Microclimate	0	0	0	Not relevant in estuary
Duwamish River RM 5.3 – mouth (both banks up to the East and West waterways)				
Bank stability	NA	NA	NA	Actual bank stability driven by levees/revetments
Shade	0.7 (4.4)	0.02 (1.7)	14.4 (93.9)	Temperature moderation function less relevant in estuary than upstream
OM/terrestrial invertebrate recruitment	0.7 (4.4)	0.02 (1.7)	14.4 (93.9)	Invertebrate recruitment supplemented by tidal marsh vegetation in limited areas
Sediment filtration	0.7 (4.4)	0.02 (1.7)	14.4 (93.9)	Function in estuary less critical than in upstream areas
LWD recruitment	0.7 (4.4)	0	14.6 (95.6)	Function in estuary less critical than in upstream areas
Microclimate	0.7 (4.4)	0	14.6 (95.6)	Not relevant in estuary

Appendix K:

Action Area Habitat Changes 1854 - 1986
(Kerwin & Nelson 2000)

Table RIP-8. The Duwamish Estuary habitat changes from 1854 to 1986 (Blomberg et al. 1988).					
	Year (percent change)				Cumulative Percent Change
Habitat Types	**1854**	**1908**	**1940**	**1986**	
Medium depth water (acres)	440	410 (-7%)	390 (-5%)	360 (-8%)	-18%
Shallows and flats (acres)	1,450	1,080 (-26%)	130 (-88%)	25 (-81%)	- 98%
Tidal marshes (acres)	1,170	970 (-17%)	160 (-84%)	20 (-88%)	- 98%
Tidal swamps (acres)	1,230	590 (-52%)	0	0	- 100%
Riparian shoreline (ft)	93,000	90,000 (-3%)	38,000 (-58%)	19,000 (-50%)	- 80%
Development Conditions					
Deep water (acres)	—	240	210 (-12%)		
Developed shorelands and floodplain (acres)	0	1,210	3,750 (+310%)	5,220 (+39%)	+430%
Developed shoreline (ft)	0	4,000	47,000 (+1175%)	53,000 (+12%)	+1,430%
New shoreline from fill (ft)	—	21,000	28,000 (+33%)	28,000	—

Appendix L:

Non-Native Marine Invertebrate & Plant Species Found in Puget Sound, 1998

(Kerwin & Nelson 2000)

Table RIP-1. Non-native marine invertebrate and plant species found in Puget Sound by the 1998 Puget Sound Expedition.			
General Taxon	Scientific Name	Native Range	First Puget Sound Record
Seaweed	<u>**Sargassum muticum**</u>	Japan	1948
Seagrass	*Spartina anglica*	England	1961-1962
Seagrass	*Zostera japonica*	Japan	1974
Foraminifera	*Trochammina hadai*	Japan	1971
Cnidaria - Hydroid	*Cordylophora caspia*	Black Sea	ca. 1920
Cnidaria - Anemone	*Diadumene lineata*	Asia	< 1939
Annelida	*Hobsonia florida*	NW Atlantic	1940
Annelida	*Pseudopolydora paucibranchiata*	Japan	1993
Mollusca – snail	*Batillaria attranmentaria*	Japan	1924
Mollusca – snail	*Crepidula fornicata*	NW Atlantic	1905
Mollusca – snail	*Myosotella mysotis*	Europe?	1927
Mollusca – bivalve	*Crassostrea gigas*	Japan	1875
Mollusca – bivalve	*Mya arenaria*	NW Atlantic	1888-1889
Mollusca – bivalve	*Nuttallia obscurata*	Japan, Korea	1993
Mollusca – bivalve	*Ruditapes philippinarum*	NW Pacific	1924
Copepoda	*Choniostomatid copepod*	Unknown	1998
Cumacia	*Nippoluecon hinumensis*	Japan	mid-1990s
Isopoda	*Limnoria tripunctata*	Unknown	1962
Amphipoda	*Ampithoe valida*	NW Atlantic	1966
Amphipoda	*Caprella mutica*	Japan	1998
Amphipoda	*Corophium acherusicum*	N Atlantic	1974-1975
Amphipoda	*Corophium insidiosum*	N Atlantic	1949
Amphipoda	*Eochelidium* sp.	Japan or Korea	1997
Amphipoda	*Grandidierella japonica*	Japan	1977
Amphipoda	*Jassa marmorata*	NW Atlantic	1990?
Amphipoda	*Melita nitida*	NW Atlantic	1998
Amphipoda	*Parapleustes derzhavini*	W Pacific	1998
Entoprocta	*Barentsia benedeni*	Europe	1998
Bryozoa	*Bowerbanki gracilis*	NW Atlantic?	< 1953
Bryozoa	*Bugula* sp.	Unknown	1993
Bryozoa	*Bugula* sp.	Unknown	1998
Bryozoa	*Bugula stolonifera*	N Atlantic	1998
Bryozoa	*Cryptosula pallasiana*	N Atlantic	1998
Tunicata	*Botrylloides violaceus*	Japan	1973
Tunicata	*Botryllus schlosseri*	NE Atlantic	1970s
Tunicata	*Molgula manhattensis*	NW Atlantic	1998
Tunicata	*Ciona savignyi*	Japan	1998
Tunicata	*Styela clava*	China	1998

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Appendix M:

Current Washington State Rules Governing Ballast Water (WDFW)

Washington Department of FISH AND WILDLIFE

New Ballast Water Rules in Effect

The 2000 legislative session passed a ballast water management law. The first rule implementing that law goes into effect as of 9/22/2000. This rule in effect makes the U.S. Coast Guard voluntary reporting program mandatory in Washington State. The primary difference is that we also require vessels involved in coastal trade to report and to conduct a ballast water exchange at least 50 miles offshore. Vessels are required to file a ballast water management report 24 hours prior to discharging ballast in state waters. They may use the Coast Guard form or the IMO form.

Forms may be filed by fax or electronically through the Seattle Marine Exchange at:

FAX: (206) 443-8205
Email: waballast@aol.com

Or vessels may report directly to the department:

Washington Dept of Fish and Wildlife
FAX (360) 902-2845
Email: ballastwater@dfw.wa.gov

For further information, please contact:

Scott Smith
(360) 902-2724
smithsss@dfw.wa.gov

or

Pam Meacham
(360) 902-2741
meachpmm@dfw.wa.gov

For more information:

NEW SECTION

WAC 220-77-090 Ballast water management and control—Reporting and sampling requirements.

(1) At least 24 hours before a vessel subject to Chapter 108, Laws of 2000, enters Washington waters intending to discharge ballast water, or 24 hours prior to the actual discharge of the ballast water, the master of the vessel must report ballast water management information in written or electronic form to the Washington Department of Fish and Wildlife. This information may be submitted by filing a ballast water report pursuant to Title 33 CFR Part 151.2045, or the report may be forwarded through a recognized marine trade association in a timely manner. Failure to comply may trigger civil penalties under Section 8 Chapter 108, Laws of 2000.

(2) WDFW, with assistance from recognized marine trade associations, will compile the ballast water management information required under subsection (1) of this section,

compare ballast water reports with vessel arrivals, determine vessel reporting rates, and evaluate the adequacy of ballast water exchange monitoring.

(3) WDFW may at reasonable times and in a reasonable manner, during a vessel's scheduled stay in port, take samples of ballast water and sediment, may examine ballast water management records, and may make other appropriate inquires to assess the compliance of vessels with ballast water reporting and control requirements.

(4) No vessel may discharge ballast water into state waters if the ballast water has a salinity level less than thirty parts per thousand combined with viable aquatic organisms, unless specifically exempted in Chapter 108, Laws of 2000.

Find a bug or error in the system? Let us know about it!

E-mail <webmaster@dfw.wa.gov>

Appendix N:

Chemical Analysis and Physical Properties of 16 Grades of Processed Lime Stone

Calcium Carbonate

(Q-Series Ground Limestone)

C.A.S. Number: 1317-65-3

This is page 1 of 3 - Page 2 of 3 - Page 3 of 3 - Other Grades - Other Products

WC & D CODE	5501*	5502*	5503*	5504	5506
GRADE	Ultrafine	Fine	Fine	Fine	Fine
TYPICAL CHEMICAL ANALYSIS:					
CaCO3 - Calcium Carbonate (%)	96.5	96.5	96.5	96.5	96.5
MgCO3 - Magnesium Carbonate (%)	2.0	2.0	2.0	2.0	2.0
SiO2 - Silica and Silicates (%)	1.2	1.2	1.2	1.2	1.2
Other (%)	0.3	0.3	0.3	0.3	0.3
Moisture (% max.)	0.20	0.20	0.20	0.20	0.20
pH Value	9.3	9.3	9.3	9.3	9.3
TYPICAL PHYSICAL PROPERTIES:					
Median Particle Size (microns)	1.0	2.0	3.0	4.0	6.0
Dry Brightness	90	90	89	88	87
Specific Gravity	2.70	2.70	2.70	2.70	2.70
Compacted Density (lbs./ft.3)	45	52	60	60	65
Loose Density (lbs./ft.3)	30	44	40	40	45
Pounds / solid gallon	-	-	-	-	-
One Pound Bulks, (gallon)	-	-	-	-	-
Oil Absorption	21	16	15	17	16
Hegman Grind	5.5	6.5	6.0	6.0	4.0
Refractive Index	-	-	-	-	-
% Thru 325 Mesh	99.95	Trace	99.995	99.995	99.99

* Also available in surface modified grades

For additional information contact:

Customer Service

Calcium Carbonate

(Q-Series Ground Limestone)

C.A.S Number: 1317-65-3

This is page 2 of 3 - Page 1 of 3 - Page 3 of 3 - Other Grades - Other Products

WC & D CODE	5510	5511*	5512	5513	5514	5515	5516
GRADE	Medium Fine	Medium Fine	Medium Fine	Medium Fine	Granular	Granular	Granular
TYPICAL CHEMICAL ANALYSIS:							
CaCO3 - Calcium Carbonate (%)	96.5	96.5	96.5	96.5	96.5	96.5	96.5
MgCO3 - Magnesium Carbonate (%)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SiO2 - Silica and Silicates (%)	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Other (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Moisture (% max.)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
pH Value	9.3	9.3	9.3	9.3	9.3	9.3	9.3
TYPICAL PHYSICAL PROPERTIES:							
Median Particle Size (microns)	13.0	19.0	24.0	20.0	-	-	-
Dry Brightness	86	84	83	80	-	-	-
Specific Gravity	2.70	2.70	27.00	2.70	2.70	2.70	2.70
Compacted Density (lbs./ft.3)	75	80	80	80	95	95	100
Loose Density (lbs./ft.3)	50	55	55	55	85	85	90
Pounds / solid gallon	22.60	22.60	22.60	22.60	22.60	22.60	22.60
One Pound Bulks, (gallon)	-	-	-	-	-	-	-
Oil Absorption	14	12	12	12	-	-	-
Hegman Grind	2.0	-	-	-	-	-	-
Refractive Index	-	-	-	-	-	-	-
% Thru 325 Mesh	99.4	84.0	70.0	20.0	6.0	0.0	0.0

* Also available in surface modified grades

For additional information contact:

Customer Service

Calcium Carbonate

(Q-Series Surface Modified Ground Limestone)

C.A.S. Number: 1317-65-3

WC & D CODE	5521	5522	5523	5520
GRADE	Ultrafine	Fine	Fine	Medium Fine
TYPICAL CHEMICAL ANALYSIS:				
CaCO3 - Calcium Carbonate (%)	96.5	96.5	96.5	96.5
MgCO3 - Magnesium Carbonate (%)	2.0	2.0	2.0	2.0
SiO2 - Silica and Silicates (%)	1.2	1.2	1.2	1.2
Other (%)	0.3	0.3	0.3	0.3
Moisture (% max.)	0.25	0.25	0.20	-
pH Value	9.3	9.3	9.3	9.3
TYPICAL PHYSICAL PROPERTIES:				
Median Particle Size (microns)	1.0	2.0	3.0	19.0
Dry Brightness	90	90	89	84
Specific Gravity	2.70	2.70	2.70	2.70
Compacted Density (lbs./ft.3)	45	52	60	80
Loose Density (lbs./ft.3)	30	44	40	55
Pounds / solid gallon	-	-	-	22.60
One Pound Bulks, (gallon)	-	-	-	-
Oil Absorption	21	16	15	12
Hegman Grind	5.5	6.5	6.0	-
Refractive Index	-	-	-	-
% Thru 325 Mesh	99.95	Trace	99.995	84.0

For additional information contact:

Customer Service

Appendix O:

Action Area Habitat Substrate Shoreline Measurements
(Kerwin & Nelson 2000)

Table HM- 7. Elliott Bay/Duwamish Estuary habitat/substrate shoreline measurements.

Duwamish Waterway – River Mile 11.0 to River Mile 5.3

Habitat/Substrate	Linear feet	Miles	Percentage of Shoreline (both banks)
Riprap (visible from river)	33,706	6.38	56.0
Bulkhead (near vertical)	1,697	0.32	2.8
Mudbank	29,993	5.68	49.8
Shoal/mudflat (near or below MLLW)	5,342	1.01	8.9
King County levees	13,604	2.58	22.6
Trees*	21,338	4.04	35.4
Shrubs	45,140	8.55	75.0
Grass	3,126	0.59	5.2
LWD (Number per mile)		9.5	

* Includes 33 individual trees each having a 25-ft dripline (total of 850 ft)

Duwamish Waterway – River Mile 5.3 North to Mouth of Duwamish

Habitat/Substrate	Linear feet	Miles	Percentage of Shoreline (both banks)
Riprap (exposed)	40,450	7.66	49.8
Riprap (under dock)	13,000	2.46	16.0
Vertical bulkhead	4,300	0.81	5.3
Exposed sand/mud substrate	45,400	8.60	55.9
Inwater structures (e.g., moorages, extensive piling)	12,300	2.33	15.1
Vegetated shoreline	22,400	4.24	27.6
Rubble shoreline	5,450	1.03	6.7
Overwater structures (e.g., docks and piers)	12,150	2.30	15.3

Elliott Bay – Don Armeni Park to Terminal 91

Habitat/Substrate	Linear feet	Miles	Percentage of Shoreline
Riprap (exposed)	24,850	4.71	35.7
Riprap (under dock)	34,350	6.51	49.3
Vertical bulkhead/concrete sewalls	11,300	2.14	16.2
Exposed sand/mud substrate	11,750	2.23	16.9
Inwater structures (e.g., moorages, extensive piling)	10,250	1.94	14.7
Vegetated shoreline	3,150	0.60	4.5
Rubble shoreline	2,800	0.53	4.0
Overwater structures (e.g., docks and piers)	45,800	8.67	65.8

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